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FINAL VOLUME
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ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

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Volume 33, Number 8, April 30, 1976

NUCLEAR SCIENCE ABSTRACTS

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Published by the ERDA Technical Information Center

Nuclear Science Abstracts provides the only comprehensive abstracting and indexing coverage of the international nuclear science literature. It covers scientific and technical reports of the U. S. Energy Research and Development Administration and its contractors, other U. S. Government agencies, other governments, universities, and industrial and research organizations. In addition, books, conference proceedings, individual conference papers, patents, and journal literature on a worldwide basis are abstracted and indexed. Each issue of *Nuclear Science Abstracts* includes four indexes: subject, personal author, corporate author, and report number.

The following organizations scan and abstract the nuclear science literature in their respective countries for input to the International Nuclear Information System of the International Atomic Energy Agency. By special agreement, the input to INIS is simultaneously sent to the ERDA Technical Information Center to enhance the timeliness of coverage of that literature in *Nuclear Science Abstracts*.

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United Kingdom Atomic Energy Authority
Zentralstelle für Atomkernenergie-Dokumentation (West Germany)

Numerous organizations, societies, and publishers throughout the world provide *Nuclear Science Abstracts* with advance page-proof copy of their publications.

A list of the journals scanned regularly and the abbreviations used appears in the January 15 issue of *Nuclear Science Abstracts* and is supplemented in the July 15 issue. The January 15 issue also describes the scope and arrangement of the subject matter covered in *Nuclear Science Abstracts*. The subject matter covered is also described in TID-4552, *Subject Scope of Nuclear Science Abstracts*, available free from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830. An outline of the subject categories appears in the Contents of each issue.

NOTICE

The publication of *Nuclear Science Abstracts* is planned to be discontinued after Vol. 33, No. 12, dated June 30, 1976. *Atomindex*, published by the International Atomic Energy Agency and a product of the International Nuclear Information System (INIS), will provide essentially identical literature coverage, subject scope, abstracting and indexing with that of *NSA*. For all practical purposes the two journals are identical. The Energy Research and Development Administration, formerly the Atomic Energy Commission, has supported the concept and development of INIS for several years. At this time, it is quite apparent that the decentralized scanning, abstracting and indexing on a country-by-country basis is reliable and successful. Consequently, it is no longer necessary for the United States to bear the entire burden of publishing an abstract journal covering the world's nuclear literature. ERDA will continue to provide coverage of U. S. nuclear literature to INIS.

Atomindex is available on a subscription basis in the United States from UNIPUB, P. O. Box 433, Murray Hill Station, New York, New York 10016, for $150 per year including cumulative indexes. ($110 per year without cumulative indexes.) For others, *Atomindex* is available from the International Atomic Energy Agency, Publications Section, P. O. Box 590, A-1011, Vienna, Austria, at the same price.

ERDA's new journal, *ERDA Energy Research Abstracts (ERA)*, will contain abstracts and indexes to all literature of ERDA origin as well as nonnuclear energy information generated by foreign countries with which ERDA has agreements for cooperation. *ERA* is available to government agencies on the same basis as *NSA* and on an exchange basis to universities, research institutions, industrial firms, and publishers of scientific information.

The public may obtain *ERA* from the Superintendent of Documents, U. S. Government Printing Office, Washington, DC 20402. The annual subscription rate for the 12 regular issues including an annual cumulative index is $119 for domestic subscribers, and $148.75 for foreign subscribers. Individual issues will be priced at $7.40 domestic, and $9.25 foreign. Separate annual index cumulations will cost $30.50 domestic, and $38.15 foreign.

INDEXES TO *NSA*

Comprehensive indexes appear in each issue and are cumulated at the end of each volume. The report number indexes will be cumulated on both a volume and two-volume basis. Multivolume cumulations have been issued as indicated above.

All documents abstracted are indexed by subjects and personal authors. Report literature is indexed also by corporate author and report number. Each of these indexes in every issue is preceded by an introduction explaining in detail the organization of the index and the principles by which it is compiled. The reader is referred to these explanations for information not found in the brief summaries below.

Personal Authors

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

SOLDAN, D.W., Shipping container for a bottle of radioactive material, 32:20442
SOLDAT, J.K., Dosimetry of the radioactive noble gases, 32:19918 (BNWL-SA-4813)
SOLOMAKHA, D.A., Measurement of the 1.15-μm wavelength of a helium--neon laser, 32:19585

Subjects

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

Examples:

URANIUM ORES/GEOCHEMISTRY
Change of uranium concentration in plagioclase of various zones of microcline--albite--oligoclase pegmatites of Karelia, 32:19704
URANIUM ORES/LEACHING
Preparation of uranium compounds (Patent), 32:19329
URANIUM ORES/MINING
The uranium mining and its importance for the energy supply, 32:19701
URANIUM ORES/ORE PROCESSING
Supplies for the fuel cycle for Spanish nuclear power plants, 32:19702
URANIUM OXIDES
See also URANIUM DIOXIDE
URANIUM OXIDES U3O8

Corporates

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

20457 (LA-5954) 100-MHz POWER AMPLIFIER DESIGN AND CONTROL FOR A HEAVY-ION ACCELERATOR, Lunsford, J. S.; Shipley, J. P.; Sutton, J. **(Los Alamos Scientific Lab., N. Mex. (USA)).** Jul 1975. 11p. Dep. NTIS $4.00.

is indexed as:

LOS ALAMOS SCIENTIFIC LAB., N.MEX. (USA)
100-MHz power amplifier design and control for a heavy-ion accelerator, 32:20457 (LA-5954)
Characterization of transuranic solid wastes from a plutonium processing facility, 32:19398 (LA-5993-MS)
Electrical breakdown and tracking characteristics of pulsed high voltages in cryogenic helium and nitrogen, 32:19495 (LA-UR-75-1032)
Engineering concepts for laser-fusion reactor applications, 32:19493 (LA-UR-75-736)
Evaluation of pre-impregnated resin-glass systems for insulating superconducting magnets, 32:19583 (LA-UR-75-1099)

Report Numbers

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

L-	**(Misc.)**	
9389	32:20494	See N-74-35219
LA-		
2429	32:20210	Dep. NTIS, $12.00
5931	32:21563	Dep. NTIS, $5.45
LA-tr-		
75-14	32:21506	Dep. NTIS, $7.75
75-26	32:19253	Dep. NTIS, $4.00
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75-736	32:19493	Dep. NTIS, $4.00
75-791	32:20772	Dep. NTIS, $4.50
75-1331	32:19238	Dep. NTIS, $4.00
LBL-		
2874	32:19889	Dep. NTIS, $9.25
3633	32:21097	Dep. NTIS, $13.50
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AVAILABILITY OF PUBLICATIONS ABSTRACTED

Public availability of all U. S. Energy Research and Development Administration reports is indicated in the report number indexes. The availability of other reports, when known, is also indicated. The availability of some unnumbered reports is given in the abstract.

Dissertations from *Dissertation Abstracts International, Part B* that are included in *Nuclear Science Abstracts* are available from Xerox University Microfilms, 300 North Zeeb Road, Ann Arbor, Michigan 48106.

Information on the availability of the published literature and unpublished conference papers abstracted in *Nuclear Science Abstracts* can be obtained from the USERDA Technical Information Center, P. O. Box 62, Oak Ridge, Tennessee 37830.

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The Administrator of the Energy Research and Development Administration has determined that the publication of this periodical is necessary in the transaction of the public business required by law of this agency. Use of funds for printing this periodical has been approved by the Director of the Office of Management and Budget through June 30, 1978.

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NUCLEAR SCIENCE ABSTRACTS

CHEMISTRY

Refer also to abstracts 17599–17603 and 18758.

Analytical and Separations Chemistry

16583 (BARC-778) ANALYTICAL CHEMISTRY DIVISION ANNUAL REPORT FOR THE YEAR 1973. (Bhabha Atomic Research Centre, Bombay (India). Analytical Chemistry Div.). 1974. 132p. Dep. NTIS (US Sales Only) $7.00.

Research and development progress is reported in the following areas: nuclear methods; including activation analyses; spectral methods; ion exchange and solvent extraction; electro-analytical methods; physicochemical investigation of co-ordination compounds; nuclear chemistry; gas chromatography; and miscellaneous studies. (JGB)

Activation and Nuclear Reaction Procedures

Refer also to abstracts 16623, 17293, and 17541.

16584 (LYCEN-7523) A TARGET CHAMBER DESIGNED FOR ADSORPTION STUDIES USING CHARGED-PARTICLE INDUCED NUCLEAR REACTIONS. Chartoire, M.; Engerran, J.; Thomas, J. P.; Tousset, J.; Bussiere, P. (Lyon-1 Univ., 69 - Villeurbanne (France). Inst. de Physique Nucleaire). Mar 1975. 18p. INIS.

Charged particle induced nuclear reactions at low energy are particularly suited for surface determination of small amounts of light elements. The adsorption of carbon and oxygen can be followed in this way when the environment of the sample is not subject to external contamination. A target chamber for ultra high and controlled vacuum has been designed for this purpose, the main feature being the use of thin metallic windows insulating the chamber from the beam line and the detection system. Due to the nature of the detected events (charged particles from (d,p) reactions) the distortion of the obtained spectra does not prevent quantitative determination of the two elements detected on the sample. Moreover these windows allow the complete disconnection of the chamber from the beam line and the detector assembly during the necessary baking (outgassing of the walls). Preliminary results on a $CO/O_2/N_2$ gas mixture adsorbed on a polycrystalline platinum sample are given showing an excess of carbon during the process. Limitations and improvements of the system and the method are discussed. (FR)

16585 (NIM-1749) EPITHERMAL-NEUTRON-ACTIVATION ANALYSIS FOR URANIUM IN BARBERTON AND BUSHVELD GRANITES. Erasmus, C. S.; Watterson, J. I. W. (National Inst. for Metallurgy, Johannesburg (South Africa)). 7 Nov 1975. 8p. Dep. NTIS (US Sales Only) $3.50.

A simple method is described for determination of uranium in granitic rocks. The powdered samples were enclosed in a cadmium shield during their irradiation in SAFARI I. The cadmium effectively filtered out the thermal neutrons and allowed only the epithermal neutrons to interact with the samples. This method provides greater sensitivity than conventional thermal-neutron-activation and delayed-neutron-activation analyses. Although it is a more time-consuming method than the latter, it has the potential of providing concentrations below the parts-per-million level for uranium, as well as for thorium and gold. This non-destructive procedure yields a detection limit of 0.1 ppM for uranium in granite samples of 200 to 400 mg. For reasonably large batches of samples (25 to 50), the man-hours spent per sample could be as low as 0.5. (auth)

16586 (PB-239930) ACTIVATION ANALYSIS OF HEAVY METALS IN SURFACE WATERS USING ION EXCHANGE FILTER PAPERS AND CYANIDE COMPLEXING. Kolaczkowski, A. M. (Pennsylvania State Univ., University Park (USA). Dept. of Nuclear Engineering). Jun 1972. Contract DI-14-31-0001-5038. 74p. NTIS $4.25. Thesis.

A technique is described for the multielement analysis of heavy metals in surface waters. It is capable of quantitative measurements of heavy metals down to trace amounts as shown by the 10 analyses performed. It is rapid enough to show great promise in future water monitoring programs. The technique has possibilities as a useful tool for heavy metal analysis of gasoline and other petroleum products, of blood, of human lung and other tissues, of foods, and other areas, provided the sample can be dissolved into an easily handled liquid form. The technique eliminates sodium and bromine interference. The technique is very simple. (GRA)

16587 (SAND-75-5875) DEPTH PROFILING OF HYDROGEN AND HELIUM ISOTOPES IN SOLIDS BY NUCLEAR REACTION ANALYSIS. Boettiger, J.; Picraux, S. T.; Rud, N. (Aarhus Univ. (Denmark). Fysisk Inst.). 1975. 9p. (CONF-750949-2). Dep. NTIS $4.00.

From international conference on ion beam surface layer analysis; Karlsruhe, F. R. Germany (15 Sep 1975).

Recent developments in the depth profiling of hydrogen and helium isotopes in solids by use of nuclear reactions are reviewed. General considerations for depth profiling by the resonance method and by the energy-analysis method are summarized. The different nuclear reactions used for profiling of H, D, T, ^{3}He and ^{4}He are intercompared with respect to depth resolution and sensitivity, and some of the limitations of the technique are discussed. (auth)

16588 RARE EARTHS IN THE LEADVILLE LIMESTONE AND ITS MARBLE DERIVATES. Jarvis, J. C. (Colorado School of Mines, Golden); Wildeman, T. R.; Banks, N. G. Chem. Geol.; 16: No. 1, 27-37(Aug 1975).

Samples of unaltered and metamorphosed Leadville Limestone (Mississippian, Colorado) were analyzed by neutron activation for ten rare-earth elements (REE). The total abundance of the REE in the least-altered limestone is 4-12 ppM, and their distribution patterns are believed to be dominated by the carbonate minerals. The abundances of the REE in the marbles and their sedimentary precursors are comparable, but the distribution patterns are not. Europium is enriched over the other REE in the marbles, and stratigraphically upward in the formation (samples located progressively further from the heat source), the light REE become less enriched relative to the heavy REE. The Eu anomaly is attributed to its ability, unique among the REE, to change from the 3+ to 2+ oxidation state. Whether this results in preferential mobilization of the other REE or whether this reflects the composition of the pore fluid during metamorphism is unknown. Stratigraphically selective depletion of the heavy REE may be attributed to more competition for the REE between fluid and carbonate minerals in the lower strata relative to the upper strata. This competition could have been caused by changes in the temperature of the pore fluid or to the greater resistance to solution of the dolomite in the lower parts of the formation than the calcite in the upper parts. (NL)

16589 TWO-GROUP SEPARATION SCHEME FOR THE DETERMINATION OF ELEVEN TRACE ELEMENTS IN BIOLOGICAL MATERIAL BY NEUTRON ACTIVATION ANALYSIS. Steinnes, E.

(Institutt for Atomenergi, Kjeller, Norway). Anal. Chim. Acta; 78: No. 2, 307-315(Sep 1975).

The applicability of solvent extraction with tri-n-octylphosphine oxide (TOPO) in the neutron activation analysis of biological material has been studied. A two-group radiochemical separation scheme is presented. After wet oxidation, As, Se, and Hg are removed by distillation and subsequent sulfide precipitation; Ca, Cd, Co, Fe, Mo, Sc, W, and Zn are then determined after extraction with TOPO. Chemical yield is determined for the volatile group by reirradiation of the sulfide precipitate. No chemical yield determination is performed for the TOPO group. Results for six international biological standards are presented. The method is applicable to a wide variety of biological samples. (NL)

16590 NEUTRON ACTIVATION ANALYSIS FOR BULK AND TRACE ELEMENTS IN URINE. Cornelis, R.; Speecke, A.; Hoste, J. (Ghent State Univ.). Anal. Chim. Acta; 78: No. 2, 317-327(Sep 1975).

Problems in sampling urine for trace element analysis by neutron activation are systematically examined. Collection, storage, sample preparation and contamination hazards during irradiation are studied in detail. Three different sizes of urine samples are prepared for analysis, depending on the concentration and nuclear properties of the elements, and suitable multielement doped urine standards are used. As, Br, Ca, Cl, Co, Cr, Cs, Cu, Hg, I, K, Mg, Mn, Na, Rb, Se, and Zn are determined. The extreme care given to sample collection, use of "ultraclean" vials, and work in a dust-free room allows consistent values to be obtained over long periods of time. A literature review of the amounts of forty elements present in urine per day is also given. (NL)

16591 SIMULTANEOUS DETERMINATION OF ALUMINA AND SILICA IN BAUXITE BY INSTRUMENTAL NEUTRON ACTIVATION ANALYSIS WITH THE AID OF A $^{227}Ac-Be$ ISOTOPIC NEUTRON SOURCE. Alaerts, L.; op de Beeck, J. P.; Hoste, J. (Ghent State Univ.). Anal. Chim. Acta; 78: No. 2, 329-341 (Sep 1975).

A method is described for the accurate and precise determination of alumina and silica in bauxites with the aid of a $^{227}Ac-Be$ isotopic neutron source with a total neutron output of 10^8 n s^{-1}. Three ores can be analyzed in triplicate within 4 h, including the determination of the natural radioactivity of the ores. Samples are pellets pressed from a mixture of 4.5 g of powdered bauxite and 0.9 g of a wax as pelleting agent. The special flux distributions of the source allow irradiations at very different fast-to-thermal flux ratios without cadmium neutron absorbers. The drying and water re-uptake of bauxite and the natural radioactivity in these ores are discussed. The method was tested with several certified standards. A relative precision of 0.7% for the alumina determination was obtained for triplicate analyses. Vanadium is the only interfering element, the concentration of which should be determined separately or estimated; a correction procedure is given. (NL)

16592 APPLICATION OF RADIOCHEMICAL NEUTRON-ACTIVATION ANALYSIS TO THE DETERMINATION OF SELENIUM AND TELLURIUM IN GEOLOGICAL MATERIALS. Mignonsin, E. P.; Roelandts, I. (Univ., Liege). Chem. Geol.; 16: No. 2, 137-148(Sep 1975).

From 2nd reunion annuelle des sciences de la terre; Font-a-Mousson, France (22 Apr 1974).

A radiochemical neutron-activation technique for the simultaneous determination of traces Se and Te in geological materials is presented. The method is based on hydrofluoric, nitric and hydrochloric dissolution and separation by ion-exchange chromatography on Dowex 1 × 8, 100-200 mesh in chloride media. Subsequently, these elements are reduced to elemental form by means of a $TiCl^3$ precipitation. Under the described operating conditions, the calculated detection limits are 4×10^{-3} μg for Se and 9×10^{-2} μg for Te. Se and Te determinations in some U.S. Geological Survey igneous standard rocks are reported in order to assess the accuracy of the method. (NL)

16593 IN VIVO NEUTRON ACTIVATION ANALYSIS IN MAN. Osborn, S. S. (King's Coll. Hospital, London). Excerpta Med. Int. Congr. Ser.; 2: 543-546(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Technical, physical and radiation protective aspects of in vivo neutron activation analysis of man are reviewed. (NL)

16594 ACTIVATION ANALYSIS WITH HELIUM-3 PARTICLES FOR TRACES OF OXYGEN IN COPPER. Vandecasteele, C.; Hoste, J. (Ghent State Univ.). Anal. Chim. Acta; 79: 302-307 (Oct 1975).

16595 METHODOLOGY FOR HIGH-FLUX ABSOLUTE MULTIELEMENT NEUTRON ACTIVATION ANALYSIS: ENVIRONMENTAL BASELINES BY ANALYSIS OF TREE RINGS. Ricci, E. (Oak Ridge National Lab., TN). Anal. Chim. Acta; 79: 109-124(Oct 1975).

Multielement determinations by high-flux absolute n.a.a. require careful methodology to avoid systematic error. The ORNL high-flux facility with a thermal flux of 5.10^{14} $cm^{-2}s^{-1}$ and a thermal-to-resonance flux ratio of 35-45 was used in developing an instrumental absolute multielement method. The detector was calibrated for absolute counting with two independent sets of radioactivity standards for four detector source distances; the absolute activities of the standards were reproducible within accuracies of 9%. Five sources of systematic error were investigated: (a) correction for counting of cylindrical sources for 26 γ-ray energies reached 14 to 17% for photon energies below 500 keV; (b) flux variation during bombardment and within the irradiation capsule volume was not significant; (c) samples were sufficiently stable during high-flux bombardment; (d) multi-element impurities in accessory materials (polyethylene and "Nucleopore" filters) were not significant; (e) correction for sample activation during rabbit transfer was necessary for short bombardments, e.g., 8.6% for 6 s and 19.6% for 4 s. This methodology resulted in accuracies of 10-15% for most elements, as determined by analysis of N.B.S. orchard leaves and coal and of Bowen's kale standards. The method was applied to a preliminary chronological study of environmental baselines and contamination levels based on tree ring samples covering a period of 100 years.

16596 PRECISE AND ACCURATE DETERMINATION OF SILICON IN ROCKS BY 14-MeV NEUTRON ACTIVATION ANALYSIS. Biby, D. M. (Univ. of the Witwatersrand, Johannesburg). Anal. Chim. Acta; 79: 125-137(Oct 1975).

The errors associated with the measurement of silicon in silicate rocks by fast neutron activation analysis have been investigated. The accuracy has been determined by comparing the values obtained with the accepted values for 22 silicate rock standards. Precisions of 0.25% and accuracies of about 0.45% are possible.

16597 DETERMINATION OF Pd, Pt, Au, Ag, AND Ir IN COPPER BY NEUTRON ACTIVATION ANALYSIS. Govaerts, A.; Gijbels, R.; Hoste, J. (Ghent State Univ.). Anal. Chim. Acta; 79: 139-148(Oct 1975).

The determination of palladium, platinum and gold in copper metal by neutron activation analysis is described. The matrix activity was separated from the noble metals by cation-exchange adsorption. Gold was extracted; palladium and platinum were precipitated. The precipitates were counted with a low-energy photon detector. The gold results were checked by instrumental neutron activation analysis. Silver, iridium, selenium, antimony and arsenic were also determined simultaneously.

16598 COPPER MINING AND MILL ANALYSES BY γ RAYS FROM CAPTURE OF CALIFORNIUM-252 NEUTRONS. Duffey, D. (Los Alamos Scientific Lab., NM); Balogna, J. P.; Wiggins, P. F.; Elkady, A.A. Anal. Chim. Acta; 79: 149-159(Oct 1975).

Copper mill materials from Utah and Nevada and rock cores from a geothermal drill hole at the Valles Grande Caldera in New Mexico where irradiated at the Los Alamos Scientific Laboratory with neutrons from a californium-252 source (about 10^{10} n s^{-1}), and the capture γ-rays were measured. The copper response, based on the 6.89-MeV double escape line, agreed sufficiently well with the known chemical composition of the materials to indicate usefulness of this technique for exploring copper deposits and for monitoring metallurgical extraction processes.

16599 MULTI-REACTION PROTON ACTIVATION ANALYSIS FOR TRACES OF MOLYBDENUM. Krivan, V. (Max-Planck-Institut fuer Metallforschung, Stuttgart). Anal. Chim. Acta; 79: 161-173(Oct 1975).

The application of proton activation analysis to the determination of molybdenum is described. Thick molybdenum targets were bombarded with 12-MeV and 15-MeV protons. The reactions studied were $^{92}Mo(p,n)^{92}Tc$, $^{94}Mo(p,n)^{94g}Tc + {}^{95}Mo(p,2n)^{94g}Tc$, $^{95}Mo(p,n)^{95\,m}Tc + {}^{96}Mo(p,2n)^{95m}Tc$, $^{95}Mo(p,n)^{95g}Tc + {}^{96}Mo(p,2n)^{95g}Tc$, $^{96}Mo(p,n)^{96g}Tc + {}^{97}Mo(p,2n)^{96g}Tc$ and $^{100}Mo(p,2n)^{99m}Tc$. Except for the Mo + p yields ^{95m}Tc reaction, all these reactions give high analytical sensitivities. For 12-MeV protons and an irradiation time of one half-life or a maximum of 2 h, the sensitivities range from 5.102 to 6.103 dpm/ppm μA, and for 15-MeV protons and the same irradiation conditions from 103 to 104 dpm/ppm μA. In addition to the high sensitivity, the great advantage of proton activation is that different principal reactions yield indicator radionuclides with half-lives between 4.4 min and 61 d. Simultaneous determinations by these reactions are of value for checking the accuracy. For each reaction,

detailed data are given on nuclear and instrumental interferences. Analytical application of this multi-reaction proton activation analysis is illustrated by the instrumental determination of molybdenum in cobalt.

16600 DETERMINATION OF PURITY OF ION EXCHANGE RESINS BY MEANS OF NONDESTRUCTIVE NEUTRON-ACTIVATION ANALYSIS. Marichkova, L. M.; Donev, I. Y.; Baloushev, B. S. (Inst. of Nuclear Research and Nuclear Energetics, Sofia). C. R. Acad. Bulg. Sci.; 28: No. 3, 367-370(1975).

Results are reported on the neutron-activation analysis of 21 resins, 10 of which were acid cationites and 11 were basic anionites. The samples were exposed to reactor irradiation and the concentrations of Se, Cr, Cd, Rb, Fe, Zn, Cu, Br, Au, and Na were measured. The results are tabulated. All the resins contained Na and most contained Br. Relatively high quantities of Cd and Cu were found, primarily in the strongly acid cationites, but also present in the strongly basic anionites. (JSR)

16601 HEAVY METALS IN SEDIMENTS FROM THE ATHENS SEWAGE OUTFALL AREA. Papakostidis, G.; Grimanis, A. P.; Zafiropoulos, D. (Democritus Nuclear Research Center, Athens). Mar. Pollut. Bull.; 6: No. 9, 136-139(Sep 1975).

Sediments in the upper Saronikos Gulf have been contaminated by heavy metals from the discharge of untreated industrial and domestic wastewater from the area around Athens. Neutron activation analysis indicates concentrations of antimony, arsenic, chromium, gold, mercury, silver, and zinc are 8 to 200 times greater than in the surrounding uncontaminated sediments. The bottom area affected by increased metal concentrations is at least 13 km^2 and indicates a nearly radial dispersal pattern from the main outfall with higher concentrations extending to the southeast and southwest. (auth)

16602 IRRADIATION OF ELEMENTS FROM Z equals 3 TO Z equals 42 WITH 10-MeV PROTONS AND APPLICATION TO ACTIVATION ANALYSIS. Debrun, J. L.; Barrandon, J. N.; Benaben, P. (CNRS, Orleans, France). Anal. Chem.; 48: No. 1, 167-172(Jan 1976).

The sensitivities for the determination of 22 elements from Z equals 3 to Z equals 42, using 10-Mev proton activation, were calculated from experimentally measured yields for 47 radioisotopes obtained via (p,n) reactions. The error associated with the measurement of the activation yields ranged from 5 to 15 percent. For an irradiation of 1 hour at 1 mu A, the calculated sensitivities are better than 10 ppB for Ca, Ti, Cr, Ni, Cu, Ga, Ge, Zn, Se, Br, Rb, Y, Zr, and Mo; for Li, S, V, Fe, As, Sr, and Nb, these sensitivities are better than 100 parts per billion. Experimental results for the simultaneous and nondestructive analysis of several trace elements in Al, Ag, Au, Co, Dy, Ho, Ir, Nb, Pr, Rh, Si, Ta, Tb and various minerals are presented. (auth)

Chemical and Spectral Procedures

Refer also to abstracts 17194, 17215, and 19131.

16603 (BARC-797) SETTING UP OF NUCLIDE GRAF-3S SPARK SOURCE MASS SPECTROMETER FOR THE ANALYSIS OF HIGH PURITY MATERIALS. Mahalingam, T. R.; Murugaiyan, P.; Sonni, K. S.; Venkateswarlu, C. (Bhabha Atomic Research Centre, Bombay (India). Analytical Chemistry Div.). 1975. 12p. Dep. NTIS (US Sales Only) $3.50.

The setting up of a nuclidis GRAF-3S spark source mass spectrometer and its use in the analysis of silicon, zone-refined indium, and uranium metal are reported. Sample preparation is considered. (LK)

16604 (IEA-396) SPECTROGRAPHIC DETERMINATION OF TRACE IMPURITIES IN NUCLEAR GRAPHITE. Lordello, A. R.; Tognini, R. P. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Jun 1975. 17p. (In Portuguese). Dep. NTIS (US Sales Only) $3.50.

A spectrochemical method for the direct determination of B, Cd, Si, Hg, Fe, Mg, Mn, Cr, Ni, Al, Mo, Ti, Sr, Na, Zn and As in nuclear-grade graphite is described. A 9:1 ratio of graphite to copper difluoride is used in the preparation of samples and standards. The excitation is carried out in a d-c at 10 amperes. The copper fluoride used as spectrographic buffer serves to increase the volatilization rate of the impurities and to diminish the differences in the nature of the analytical and calibration samples. The relative standard deviations for the determination of the 16 trace elements, except Sr, Fe, Cd, Al and Si, are in the range of 8-20% in their appropriate calibration levels. For the latter five elements they are approximately 20-40%. The sensitivities compare favorably with or even better than other spectrographic methods reported in the literature. (auth)

16605 (KFKI-75-67) NMR METHOD FOR QUANTITATIVE ANALYSIS OF METALLIC ALLOYS. Tompa, K.; Balla, K. Z. (Magyar Tudomanyos Akademia Kozponti Kemiai Kutato Intezete, Budapest). 1975. 13p. Dep. NTIS (US Sales Only) $4.25.

The nuclear magnetic resonance (NMR) method is employed for the first time for quantitative analysis of metallic alloys, thereby enabling the nondestructive determination of the concentration of foreign atoms present in a dissolved state in the metal matrix. Valuable information can be obtained on the real structure of alloys by comparing dissolved impurity content obtained by NMR measurements and total impurity content determined chemically. The method is based on the measurement of the NMR intensity as a function of dissolved foreign atoms; the NMR signal intensity being measured through the derivative signal amplitude D with log D expressed as a linear function of the foreign atom concentration c. The slope of the curve depends on the quality of the foreign atom. Sample preparation, apparatus and procedure are given. (auth)

16606 MICRO-74. Proceedings of Royal Microscopical Society Meeting Held at London, England, 8–12 July 1974. Proc. R. Microsc. Soc.; 9: 1-94(1974). (CONF-740763–).

The sixteen sessions of the meeting were: low temperature techniques and critical joint drying in light and electron microscopy, microscopy of timber and timber products, problems in the laboratory, preparative techniques and histochemistry, electron histochemistry of biological polymers, high performance ceramic materials, microanalysis of biological materials, biological materials, structure of interfaces in metallic systems, the eye as an instrument, immunohistochemistry, microanalysis of materials, histochemical aspects of human pathology, microscopy and prevention of materials failures, botanical histochemistry, and microscopy of polymers and fibers. (LK)

16607 DETERMINATION OF RARE-EARTH ELEMENTS IN USGS STANDARD ROCKS BY MIXED-SOLVENT ION EXCHANGE AND MASS-SPECTROMETRIC ISOTOPE DILUTION. Hooker, P. J.; O'Nions, R. K.; Pankhurst, R. J. (Oxford Univ.). Chem. Geol.; 16: No. 3, 189-196(Nov 1975).

The development is described of a mixed-solvent ion-exchange technique for separating trace amounts of rare-earth elements from silicate rocks and minerals. A two-column method is used, bulk separation of rare earths from other elements being accomplished on the first, and separation into three groups for mass-spectrometric analysis on the second. This has been applied to the determination of nine REE(La, Ce, Nd, Sm, Eu, Gd, Dy, Er and Yb) in standard rock samples. Smooth variation of the chondrite-normalized abundance distributions and comparison with other published results indicate that the accuracy of the method with the exception of La, is generally ±2%. (NL)

16608 DETERMINATION OF SEVEN TRACE ELEMENTS IN NATURAL WATERS AFTER SEPARATION BY SOLVENT EXTRACTION AND ANION-EXCHANGE CHROMATOGRAPHY. Korkisch, J.; Sorio, A. (Univ., Vienna). Anal. Chim. Acta; 79: 207-218(Oct 1975).

A method is described for the determination of cadmium, cobalt, copper, manganese, lead, uranium, and zinc in samples of natural waters. After acidification with hydrochloric acid, the water sample is filtered and the diethyldithiocarbamates of the trace elements are isolated by extraction with acetone–chloroform (2:5) at pH 5. Following this preconcentration step, the metal ions are adsorbed on a column of the strongly basic anion-exchange resin Dowex 1-X8 (chloride form) using as sorption solution a mixture (5:4:1, v/v) of tetrahydrofuran, methyl glycol and 6 M hydrochloric acid. Successive elution is effected with 6 M hydrochloric acid (Co, Cu, Mn and Pb), 1 M hydrochloric acid (U) and 2 M nitric acid (Cd and Zn); the metal ions in the eluates are determined by atomic absorption spectrophotometry (except uranium, which is determined fluorimetrically). The procedure was used to determine the trace metals in water and snow samples collected in Austria and to analyze a sample of seawater from the Adriatic Sea.

16609 SPECTRAL LINE INTERFERENCE IN THE ATOMIC ABSORPTION SPECTROMETRY OF LANTHANIDES. Ooghe, W.; Verbeek, F. (Ghent Univ.). Anal. Chim. Acta; 79: 285-291(Oct 1975).

16610 USE OF 1-HYDROXY-2-CARBOXYANTHRAQUINONE FOR THE SPECTROFLUOROMETRIC DETERMINATION OF Be(II). Capitan, F.; Salinas, F.; Franquelo, L. M. (Univ. of Granada, Spain). Anal. Lett.; 8: No. 10, 753-761(1975).

A new spectrofluorometric method for the determination of beryllium using 1-hydroxy-2-carboxyanthraquinone as the reagent is described. A study of the interference by foreign ions was also completed. (auth)

16611 DETERMINATION OF URANIUM IN PLUTONIUM-238 METAL AND OXIDE BY DIFFERENTIAL PULSE POLAROGRAPHY. Fawcett, N. C. (Los Alamos Scientific Lab., NM). Anal. Chem.; 48: No. 1, 215-218(Jan 1976).

A differential pulse polarographic method was developed for the determination of total uranium in ^{238}Pu metal and oxides. A supporting electrolyte of 0.5 M ascorbic acid in 0.15 N H_2SO_4 was found satisfactory for the determination of 500 ppM or more of uranium in 10 mg or less of plutonium. A relative standard deviation of 0.27 to 4.3 percent was obtained in the analysis of samples ranging in uranium content from 0.65 to 2.79 percent. The limit of detection was 0.18 mu g ml^{-1}. Peak current was a linear function of uranium concentration up to at least 100 mu g ml^{-1}. Amounts of neptunium equal to the uranium content were tolerated. The possible interference of a number of other cations and anions were investigated. (auth)

16612 ANALYTICAL UTILITY OF THE M SERIES X-RAY EMISSION LINES APPLIED TO URANIUM, NEPTUNIUM, PLUTONIUM, AND AMERICIUM. Miller, A. G. (Atlantic Richfield Hanford Co., Richland, WA). Anal. Chem.; 48: No. 1, 176-178 (Jan 1976).

Secondary emission x-ray analysis for actinide elements has usually meant utilizing the L series x-ray lines. The major disadvantage of these x-ray lines is that they fall in the region of high level Bremsstrahlung radiation, producing a high background and, subsequently, larger error and high detection limits. The utilization of the M series x-ray lines of actinide elements with wavelength dispersive x-ray spectrometers greatly minimizes these problems. Calibration curves for uranium, neptunium, plutonium, and americium were prepared by the "coprex" method, and the analytical characteristics of the L and M series compared. The M alpha and beta x-ray lines, under optimum conditions, are several times more sensitive than their L series counterparts. With the greater sensitivity in addition to the lower background, peak to background ratios for M lines up to 40 times greater than those for L lines were obtained. Detection limits can be lowered from about 0.7 mu g using the L $alpha_1$ line to 0.05 mu g when M x-ray lines are used. The relative advantages and disadvantages of utilizing the L and M series x-ray lines for secondary emission x-ray analysis are discussed. (auth)

16613 SOLVENT EXTRACTION OF NIOBIUM-4-(2-PYRIDYLAZO)RESORCINOL COMPLEX AND SPECTROPHOTOMETRIC DETERMINATION OF NIOBIUM IN OXALATO SOLUTIONS. Siroki, M. (Univ., Zagreb, Yugoslavia); Maric, L.; Herak, M. J.; Djordjevic, C. Anal. Chem.; 48: No. 1, 55-59(Jan 1976).

Solvent extraction of niobium in the form of the pyridylazo resorcinol complex was studied. The strongly colored niobium complex which forms at pH 5.5 and contains 4-(2-pyridylazo)resorcinol and oxalate as ligands can be extracted into the chloroform by means of the tetraphenylarsonium and tetraphenylphosphonium chloride, respectively. The mechanism of the extraction is based on the formation of the ion-associated compounds that form between the hydrophobic organic cation and the oxo(oxalato)(pyridylazoresorcinolo)niobate(V) anion. The chloroform phase is more stable than the aqueous solutions of the complex, and it follows Beer's law in a significantly wider concentration range. A method was developed for the spectrophotometric determination of niobium in the organic phase after the chloroform extraction. This method has certain advantages over the niobium determination with 4-(2-pyridylazo)resorcinol in the aqueous oxalate medium. (auth)

16614 SEQUENTIAL DETERMINATION OF ARSENIC, SELENIUM, ANTIMONY, AND TELLURIUM IN FOODS VIA RAPID HYDRIDE EVOLUTION AND ATOMIC ABSORPTION SPECTROMETRY. Fiorino, J. A.; Jones, J. W.; Capar, S. G. (Food and Drug Administration, Washington, DC). Anal. Chem.; 48: No. 1, 120-125 (Jan 1976).

Analysis of acid digests of foods for As, Se, Sb, and Te was semiautomated. Hydrides generated by controlled addition of base stabilized $NaBH_4$ solution to acid digests are transported directly into a shielded, hydrogen (nitrogen diluted), entrained-air flame for atomic absorption spectrophotometric determination of the individual elements. The detection limits, based on 1 g of digested sample, are approximately 10 to 20 ng/g for all four elements. Measurement precision is 1 to 2 percent relative standard deviation for each element measured at 0.10 mu g. A comparison is made of results of analysis of lyophilized fish tissues for As and Se by instrumental neutron activation (INAA), hydride generation with atomic absorption spectrometry, fluorometry, and spectrophotometry. NBS standard reference materials (orchard leaves and bovine liver) analyzed for As, Se, and Sb by this method show excellent agreement with certified values and with independent NAA values. (auth)

Radiometric and Radiochemical Procedures

Refer also to abstracts 16681, 17168, 17210, 17214, 17246, and 17253.

16615 (ORNL-5046, pp 72-74) DEVELOPMENTS IN ALPHA SPECTROMETRY WITH LIQUID SCINTILLATORS. Thorngate, J. H.; McDowell, W. J.; Perdue, P. T.; Christian, D. J. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Liquid organic scintillators, combined with solvent extraction techniques, provide a sensitive means to measure small amounts of alpha-emitting heavy metals. Moreover, pulse-shape discrimination procedures can reduce the background from pulses produced in the scintillator by electrons to below 0.01 count/min. Recently, an effort was conducted to optimize both the detection system and the solvent extraction process. The scope of the program was limited to bone and tissue samples, because the Medical Physics and Internal Dosimetry Section of the Health Physics Division was interested in measuring plutonium in such samples. Progress is reported. (WHK)

16616 (SAND-75-5604) SOME PRACTICAL ASPECTS OF DEPTH PROFILING GASES IN METALS BY PROTON BACKSCATTERING: APPLICATION TO HELIUM AND HYDROGEN ISOTOPES. Blewer, R. S. (Sandia Labs., Albuquerque, N. Mex. (USA)). 1975. 15p. (CONF-750949-10). Dep. NTIS $3.50.

From international conference on ion beam surface layer analysis; Karlsruhe, F. R. Germany (15 Sep 1975).

Maximum detection sensitivity for hydrogen isotopes and helium is achieved by employing thin foil samples backed by a "beam trap" to prevent any portion of the incident beam which is not backscattered in the foil sample from reaching the detector. Measurements have been made to determine the magnitude and origin of "tail" or "background" counts which appear in parts of the spectra which ideally should contain no counts and which, by their presence, reduce the detection sensitivity that should theoretically be achievable for light elements. For copper foil targets, the ratio of the counts per channel of the Cu peak to the counts per channel for the background is approximately 5×10^3. The energy distribution of the background has been measured and leads one to the conclusion that for the apparatus used, these counts arise principally from decollimated incident beam protons which strike the sample holder instead of the foil sample. The enhancement in elastic scattering cross section for protons incident on ^4He is discussed and the enhancement factor for a number of other low Z elements is tabulated both for E_0 equals 2.5 MeV and for energies at which sharp resonances exist. Example spectra will be drawn from fusion reactor first wall studies presently being conducted which illustrate the effect of applying the principles discussed.

16617 SCINTILLATION COUNTING OF ^{32}P BY A SIMPLE AND DIRECT METHOD. Noble, R. C.; Towers, G.; West, D. (Hannah Research Inst., Ayr, Eng.). Newsletter on the Application of Nuclear Methods in Biology and Agriculture; No. 3, 12-13 (Nov 1974).

16618 FLOW VERSUS BATCH DETECTION OF RADIOACTIVITY IN COLUMN LIQUID CHROMATOGRAPHY. Sieswerda, G. B.; Poppe, H.; Huber, J. F. K. (Amsterdam Univ.). Anal. Chim. Acta; 78: No. 2, 343-358(Sep 1975).

For column liquid chromatography, the precision of flow counting of radioactivity is compared with that of batch counting. Theoretical derivations are presented to show the decrease of precision in flow counting as a function of the sample count rate, the background count rate, and the residence time in the detector cell. A long residence time in the detector cell enhances the precision of the results, but this time can only be increased at the expense of either chromatographic resolution or retention time. The compromises which have to be made are treated quantitatively. Experimental results are shown which support the theoretical conclusions. The measurements were carried out with a GM counter, a NaI(Tl) crystal and an organic solid scintillator. It is demonstrated that the selectivity of radiometric detection can be used to improve the accuracy of the analytical results. (NL)

16619 DETERMINATION OF CYANOCOBALAMIN IN RADIOACTIVE CYANOCOBALAMIN SAMPLES BY REVERSE ISOTOPE DILUTION ANALYSIS. Pandey, V. N.; Rao, K. P. S. (Bhabha Atomic Research Centre, Trombay, India). Radiochem. Radioanal. Lett.; 23: No. 3, 175-180(15 Nov 1975).

A simple and rapid method has been developed for the determination of the specific activity of radioactive cyanocobalamin. In this method, blood serum is used as cyanocobalamin binding

factor and coated charcoal or DEAE cellulose is used for adsorption. The results obtained by this method have been found to be in close agreement with that of microbiological assay using Euglena gracilis. (auth)

16620 DETERMINATION OF ^{95}Zr AND ^{97}Zr IN A SOLUTION OF FISSION PRODUCTS BY SUBSTOICHIOMETRY. Lefevre, H.; Metzger, G.; Le Nagard, M. (Centre d'Etudes de Bruyeres-Le-Chatel, Montrouge, France). Radiochem. Radioanal. Lett.; 23: No. 3, 155-167(15 Nov 1975). (In French).

^{97}Zr and ^{95}Zr can be determined simultaneously in a solution of fission products by measuring the gamma activities at 724 keV, 743 keV and 756 keV of a fraction substoichiometrically extracted by means of a zirconium complex. The standard solution of ^{95}Zr is used to calibrate the Ge(Li) semiconductor detector for the three gamma energies. (auth)

16621 ULTRASONIC TREPANNING TECHNIQUE FOR RADIAL SAMPLING OF CERAMIC FUEL PELLETS. Yaggee, F. L.; Dragel, G. M. (Argonne National Lab., IL). Nucl. Technol.; 27: No. 2, 292-300(Oct 1975).

An ultrasonic trepanning technique for use in the radial sampling of small-diameter ceramic fuel pellets takes an initial sample in the form of a small-diameter solid cylinder from the center of the pellet. Subsequent samples are thin-wall concentric hollow cylinders. Radial samples 1.56 to 6.80 mm in diameter and 5.35 to 6.80 mm long have been obtained from 93 percent dense UO_2 pellets and 91 percent dense mixed-oxide (UO_2-PuO_2) fuel pellets. Cylindrical samples with wall thicknesses of 0.25 to 0.44 mm can be obtained without difficulty. Diameters and wall thicknesses of individual samples and concentricity between samples can be held within +-0.01 mm, at a sample cutting rate of 0.02 mm/s. The technique has been adapted to existing ultrasonic grinding equipment located in a shielded glove-box facility, which had been used for less precise ultrasonic drilling operations. The technique is currently being used to obtain radial samples from fresh (unirradiated) mixed-oxide fuel pellets that have been subjected to low-burnup exposure in the transient test reactor (TREAT). The individual samples taken from each pellet undergo burnup analysis using standard gamma-counting techniques. The gamma emitters are the ^{140}Ba-^{140}La daughters formed during the radioactive decay of the activated fuel pellets. The analytical results, expressed as fiss/(g s), obtained for discrete radial locations provide the necessary information on the radial power distribution within the individual pellet. (auth)

16622 METHOD OR SEPARATION AND MEASUREMENT OF NICKEL-63 IN ENVIRONMENTAL SAMPLES. Bhat, I. S.; Lyer, R. S.; Chandramouli, S. (Environmental Survey Lab., Maharashtra, India). Anal. Chem.; 48: No. 1, 224(Jan 1976).

Nickel-63 is separated from other radionuclides in environmental samples containing various fission and activation products. The method used involves anion exchange, precipitation of the Ni as Ni-dimethyl glyoxime complex, and a gel scintillation counting technique for ^{63}Ni measurement. (auth)

16623 RADIOANALYTICAL CHEMISTRY. Gilmore, G. R. (Universities Research Reactor, Risley, Eng.); Newton, G. W. A. Radiochemistry (London); 2: 175-238(1975).

The review is covered in sections entitled: non-activation methods--including isotope dilution, radiometric titration, kryptonates, radio-reagent methods; activation methods--including epithermal neutron activation, errors and corrections in activation analysis, 14 MeV neutron irradiation, non-neutron methods, separation methods in activation analysis, computers in gamma ray spectrometry; applications of thermal neutron methods--including biology and medicine, environment and toxicology, geochemistry and cosmochemistry, archaeology, industrial applications. (UK)

Separation Procedures

Refer also to abstract 17691.

16624 (INER-0186) SEPARATION OF ^{95}Zr AND ^{95}Nb FROM IRRADIATED URANIUM BY SILICA GEL ADSORPTION. Lin, H. C.; Ting, G. (Institute of Nuclear Energy Research, Lung-Tan (Taiwan)). Sep 1975. 29p. Dep. NTIS (US Sales Only) $4.00.

Distribution coefficients have been measured from ruthenium, cerium, zirconium and niobium in the systems silica gel--nitric acid. Ruthenium and cerium had no significant adsorption. Zirconium showed an adsorption maximum at 1 N HNO_3. The adsorption of niobium increases with increasing nitric acid concentration from 0.1 to 15 M. A rapid separation and determination of carrier-free zirconium and niobium method in uranium fission products is evolved from the equilibrium data on silica gel--nitric acid. Finally, Nb-95, Zr-95, Ru-103, 106, Cs-137 and Ce-141, 144 were separated from one gram of irradiated uranium by silica gel adsorption and cation exchanger. The chemical yield and the radiochemical purity of Zr-95 and Nb-95 are normally greater than 99%. (auth)

16625 EXTRACTION OF SCANDIUM WITH SULFOXIDES. Kazantseva, N. N.; Semenov, S. A.; Reznik, A. M.; Yurchenko, L. D. (Moscow Inst. of Fine Chemical Tech.). Zh. Neorg. Khim.; 20: No. 5, 1431-1433(May 1975). (In Russian).

The extraction of Sc from HCl solution with butylbenzylsulfoxide was studied. It was found that the solvation number is equal to two. An extraction mechanism was proposed, and the extraction constants were evaluated. The extraction of Sc from $MgCl_2$ solution was also studied. (tr-auth)

16626 EXTRACTION OF MICROQUANTITIES OF CURIUM AND CERIUM BY DI-2-ETHYLHEXYLPHOSPHORIC ACID FROM LACTIC ACID SOLUTIONS. Nikolaev, V. M.; Lebedev, V. M. Zh. Neorg. Khim.; 20: No. 5, 1359-1361(May 1975). (In Russian).

During the study of the extraction of microquantities of Cm and Ce from lactic acid solution with HDEHP using the Froneus method, the formal values of the concentration stability constants of the lactate complexes of these elements β_1, β_2, β_3, and β_4 were calculated. A model was proposed for the extraction system studied, taking into consideration the formation in the organic phase of both the simple complexes of Me^{3+} with dimers of HDEHP $Me(HA_2)_3$ and mixed complexes containing the lactate ion also $MeLact(HA_2)_2$. By using the values of β_n found the system could be satisfactorily described and the change of the tangent of the angle of the slope of the relation lg D = f lg [HDEHP] for different concentrations of the extractant could be explained. (tr-auth)

16627 SOME REGULARITIES IN THE EXTRACTION OF PHOSPHOMOLYBDENUM AND SILICOMOLYBDENUM COMPLEXES WITH ALIPHATIC ALCOHOLS AND COMPLEX ETHERS. Pilipenko, A. T.; Shkaravskii, Yu. F. Zh. Neorg. Khim.; 20: No. 5, 1352-1358(May 1975). (In Russian).

The study of the effect of the hydrogen ion concentration and aliphatic alcohol concentration on the extraction of Mo heteropolyacids by alcohols showed that during the transfer of the phosphomolybdate ion into the organic solvent phase the combination of one hydrogen atom and five alcohol molecules occurred, whereas the transfer of the silicomolybdate ion into the organic solvent phase was accompanied by the combination of two hydrogen atoms and eight alcohol molecules. The phosphomolybdate is extracted as the complex $H'H_2''PMo_{12}O_{40}\cdot 5AlcOH$, where the indices ' and '' indicate the more and less strongly dissociated hydrogen atoms, respectively. For the silicomolybdates the extracted complex is $H_2'H_2''SiMo_{12}O_{40}\cdot 8AlcOH$. The extraction coefficients were calculated with consideration of these forms of the compounds. (tr-auth)

16628 ELECTROOSMOTIC CONCENTRATION OF THE CATION FORMS OF ELEMENTS FROM EXTREMELY DILUTED AQUEOUS SOLUTIONS. Moskvin, L. N.; Kalinin, N. N.; Godon, L. A. At. Energ. (USSR); 39: No. 2, 94-97(Aug 1975). (In Russian)

The method of production of the porous positive charged membranes on the basis of chromatographic aluminium oxide is offered and their electrokinetic properties are investigated. The penetration of porous positive charged membranes respective to the cation forms of elements for concentrating degree no more than 10^4 is explored. By electroosmotic removal of water the quantitative concentrating of cation forms of different elements is accomplished. It is demonstrated with following chromatographic separation of radioactive isotopes ^{137}Cs and ^{90}Sr (^{90}Y). The results confirm the possibility of effectively using electroosmosis for concentrating cation forms of elements from dilute aqueous solutions for the purpose of increasing their determination. (auth)

Inorganic, Organic, and Physical Chemistry

Chemical and Physicochemical Properties

Refer also to abstracts 17137 and 17881.

16629 (BNL-20753) ADVANTAGES OF NEUTRON SCATTERING FOR BIOLOGICAL STRUCTURE ANALYSIS. Schoenborn, B. P. (Brookhaven National Lab., Upton, N. Y. (USA)). 1975. 16p. (CONF-750629-7). Dep. NTIS $3.50.

From symposium on neutron scattering for the analysis of biological structures; Upton, New York, USA (2 Jan 1975).

The advantages and disadvantages of neutron scattering for

protein crystallography, scattering from oriented systems, and solution scattering are summarized. Techniques for minimizing the disadvantages are indicated. (JSR)

16630 (CEA-R-4719) PHENOMENOLOGICAL THEORY AND ATOMIC THEORY IN RELATION TO THE CHEMICAL DIFFUSION, RELATIONSHIPS OF ONSAGER. Gomez, J. P.; Remy, C.; Calais, D. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France)). Dec 1975. 18p. (In French). Dep. NTIS (US Sales Only) $3.50.

Chemical diffusion is an irreversible process whose evolution can be easily controlled. However, the phenomenological theory, based on the thermodynamics of open systems, proves to be unable to verifying ONSAGER's relationships. It does not contain a method for the calculation of the independent phenomenological coefficients, found in the general expressions for fluxes under isothermal and isobar conditions. The atomic theory of Manning with some simplificating hypothesis allows the calculation of the phenomenonological coefficients as a function of diffusion coefficients. (auth)

16631 (UCRL-51965) CHEMISTRY OF ALIPHATIC SULFURPENTAFLUORIDE DERIVATIVES. Bissell, E. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 20 Nov 1975. Contract W-7405-Eng-48. 20p.

This report summarizes the literature through 1974 on aliphatic sulfurpentafluoride compounds. Methods of preparation and methods of transforming one pentafluorothio compound into another are briefly discussed. The physical properties of all known derivatives are tabulated. (auth)

16632 SINGULARITIES OF THE HEAT EXCHANGE DURING TUBE COOLING OF TURBULENT FLOW OF THE CHEMICAL NON-EQUILIBRIUM SYSTEM N_2O_4 IN EQUILIBRIUM $2NO_2$ IN EQUILIBRIUM $2NO + O_2$. Devoino, A. N.; Mirgorodskii, V. S. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 3, 60-65(1974). (In Russian).

Heat transfer data for the dissociation of N_2O_4 during flow cooling in a tube at a pressure of 80 atm are given. The influence of various factors on heat transfer under given conditions are presented. (auth)

16633 GENERALIZATION OF TEST DATA ON THERMAL EFFICIENCY DURING CONDENSATION ON HORIZONTAL TUBES WITH TRANSVERSE FINS. Derov, V. T.; Kolykhan, L. I.; Nesterenko, V. B.; Pulyaev, V. F. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 3, 66-70(1974). (In Russian).

Results of experimental heat transfer data treatment are given considering rib efficiency for vapor condensation in the N_2O_4 equilibrium system; horizontal finned tubes with transverse trapezoidal ribs of the stainless steel were applied. A criterion equation generalizing the experimental data with an accuracy of ±10% was obtained. Vapor condensation of low boiling substances (N_2O_4, freon 113 and 21), finned tubes of various materials (stainless steel, brass, copper), and rib geometry were used in the conditions of prevailing influence on surface tension forces. (auth)

16634 EXPERIMENTAL DATA ON THE SPEED OF SOUND IN GASEOUS DISSOCIATING NITROGEN TETRAOXIDE. Nikolaev, V. A.; Timofeev, B. D. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 3, 78-80(1974). (In Russian).

Tables of smoothed data on sound speed in gaseous nitrogen tetraoxide are presented. The tables present the graphical smoothing of the experimental data within the temperature range of 70 to 180°C and pressure range of 5 to 50 atm. (auth)

16635 COEFFICIENT OF DYNAMIC VISCOSITY OF GASEOUS DISSOCIATING NITROGEN TETRAOXIDE. Belyaeva, O. V.; Timofeev, B. D.; Yagodnitsyn, V. S. (Inst. of Nuclear Energy, Minsk). Vesti Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 2, 65-70(1974). (In Russian).

Viscosities were obtained with a falling cylinder viscosimeter for dissociating nitrogen tetroxide in the temperature range 420 to 690°K and 10 to 140 bar. Error is less than 3%. Experimental viscosities obtained during this study were approximated by the two-parameter polynomial from the least square fit. (auth)

16636 EXPERIMENTAL STUDY OF THE QUANTITY OF ADMIXTURES IN THE BOUNDARY LAYER OF VAPOR-LIQUID CURRENT OF N_2O_4. Kolykhan, L. I.; Sen'ko, A. S. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 2, 71-75(1974). (In Russian).

Results of experiments to determine the content of an admixture of $HNO_3 + H_2O$ in a liquid film when a nitrogen tetroxide two-phase flux is moving under heating conditions in a vertical tube are given. The analysis of the admixture influence on heat exchange is shown. (auth)

Isotope Effects

Refer also to abstracts 16683 and 18368.

16637 STEREOCHEMISTRY OF ALIPHATIC CARBOCATIONS. Pt. 10. Rearrangements of 3-Methyl-2-Butyl Cations. Kirmse, W.; Krause, D. (Bochum Univ. (F. R. Germany). Abt. fuer Chemie). Chem. Ber.; 108: No. 6, 1855-1863(1975). (In German) 2 tabs.; 18 refs.

The deamination of (R)-[2-D]-1,2-dimethylpropylamine in acetic acid at 50°C afforded alkenes, cyclopropanes, and acetates in ratios very similar to those obtained with the undeuteriated amine. The 1,2 hydride shift leading to tert amyl cation proceeds with 66% inversion (34% racemization) at the migration terminus, as judged from the optical rotation of [3-D_1]-2-methyl-1-butene. (DE)

16638 ARYLDIAZO COMPLEXES. Syntheses and Reactions of New Complexes of Osmium and Ruthenium. Haymore, B. L.; Ibers, J. A. (Northwestern Univ., Evanston, IL). Inorg. Chem.; 14: No. 11, 2784-2795(Nov 1975).

Aryldiazo complexes, $[M(CO)_2(NNPh)(PPh_3)_2][PF_6]$ (M equals Os, Ru; Ph equals C_6H_5), were prepared by allowing diazonium salts to react with $M(CO)_3(PPh_3)_2$. Infrared spectra of the Ru complex suggest the presence of two isomers both in solution and in the solid state. These complexes react with a variety of coordinating anions (X^-), to form $MX(CO)_2(NNPh)(PPh_3)_2$. The osmium derivatives have nu(NN) near 1455 cm^{-1}, which is the lowest value yet reported for a nonbridging aryldiazo ligand. The first aryldiazo-hydrido complexes, $MH(CO)_2(NNPh)(PPh_3)_2$ and $MH(CO)(NNPh)(PPh_3)_2$, were prepared by deprotonation of the respective phenyldiazene complexes, $MH(CO)_2(HNNPh)(PPh_3)_2^+$ and $MH(CO)(HNNPh)(PPh_3)_3^+$. The compound $OsCl_2(NNPh)(PPh_3)_2$ was also prepared. A large number of the foregoing complexes were synthesized with selective ^2H and ^{15}N labels. Infrared and NMR spectra show $MX(CO)_2(NNPh)(PPh_3)_2$ and the analogous hydrido complex to be pseudooctahedral with trans phosphine ligands, cis carbonyl ligands, and a doubly bent phenyldiazenido ($NNPh^-$) ligand. Similarly, $MH(CO)(NNPh)(PPh_3)_2$ possesses a trigonal-bipyramidal geometry with trans phosphine ligands and an equatorial, singly bent phenyldiazoniumato ($NNPh^+$) ligand. Isotopic substitution of the diazo ligand shows that nu(NN) is often vibrationally coupled with phenyl vibrational modes and that two or three bands sometimes shift upon ^{15}N substitution. Vibrational coupling was also observed in the higher energy region (1850 to 1900 cm^{-1}) in the compound $RuCl_3(NNC_6D_5)(PPh_3)_2$. The wide range in the values of nu(NN), $RuCl_3(NNPh)(PPh_3)_2$ (1882 cm^{-1}) vs. $RuCl(CO)_2(NNPh)(PPh_3)_2$ (1462 cm^{-1}), indicates that the N–N stretching frequencies are sensitive to the electronic and steric environment of the diazo ligand. The aryldiazo complexes are compared with analogous, isoelectronic nitrosyl complexes of Os and Ru. (auth)

16639 SPECTRA AND STRUCTURE OF PHOSPHORUS—BORON COMPOUNDS. XI. Microwave Spectrum, Structure, Dipole Moment, and Barrier to Internal Rotation in Phosphine—Trifluoroborane. Odom, J. D.; Kalasinsky, V. F.; Durig, J. R. (Univ. of South Carolina, Columbia). Inorg. Chem.; 14: No. 11, 2837-2839(Nov 1975).

The microwave spectra in the R band of four isotopic B-10 and -11, H and D) symmetric-top species of phosphine–trifluoroborane ($H_3P{\cdot}BF_3$) were observed. A staggered conformation and r(P–H) equals 1.40 A and angle HPB equals 117° from $H_3P{\cdot}BH_3$ were assumed, and the remaining structural parameters were calculated, by a least-squares fitting of the four observed moments of inertia, to be the following: r(P–B) equals 1.921 ± 0.007 A, r(B–F) equals 1.372 ± 0.002 A, angle FBP equals 106.69 ± 0.38°. The dipole moment was found from Stark splittings to be 3.73 ± 0.30 D in the ground state. The barrier to internal rotation was determined to be 3.39 ± 0.40 kcal/mole by using the relative intensity method. These quantities are compared to corresponding values for related molecules. (auth)

16640 VIBRATIONAL SPECTRA AND STRUCTURE OF BIPHOSPHINE AND BIPHOSPHINE-d_4. Odom, J. D.; Wurrey, C. J.; Carriera, L. A.; Durig, J. R. (Univ. of South Carolina, Columbia). Inorg. Chem.; 14: No. 11, 2849-2853(Nov 1975).

Infrared and Raman spectra were obtained for biphosphine and biphosphine-d_4 in both solid and vapor phases. From the spectral data it is concluded that only one conformer exists in both solid and fluid phases and that this is the gauche conformer. A normal-coordinate analysis was also performed, in which the 24 vibrational frequencies of the two isotopes were fitted by 10 force constants to an overall average error of 1.0 percent. The PED indicates that there is practically no mixing of the normal modes in the P_2H_4 molecule but the P–P stretch and the PD_2 wagging modes are extensively mixed for the P_2D_4 molecule. (auth)

16641 PURE ROTATIONAL RAMAN SPECTRA OF $^{79}Br_2$ AND $^{81}Br_2$. Baierl, P.; Hochenbleicher, J. G.; Kiefer, W. (Univ., Munich). Appl. Spectrosc.; 29: No. 4, 356-357(1975).

The results of the measurement of the rotational Raman spectra of isotopically pure species $^{79}Br_2$ and $^{81}Br_2$ were reported. It is shown that the pure rotational Raman spectra of fairly heavy linear molecules can be obtained directly with photoelectric recording. (JSR)

16642 DEUTERIUM ISOTOPE EFFECTS AND THE INFLUENCE OF SOLVENT IN THE REDOX AND REARRANGEMENT REACTIONS OF 2-PICOLINE N-OXIDE AND PHENYLACETIC ANHYDRIDE. Jenkins, J. A. (Otterbein Coll., Westerville, OH); Cohen, T. J. Org. Chem.; 40: No. 24, 3566-3571(28 Nov 1975).

The reaction of 2-picoline N-oxide with phenylacetic anhydride proceeds by two paths: rearrangement to produce picolyl phenylacetate, 2-(beta-phenylethyl)pyridine, other minor rearrangement products, and CO_2, and oxidation to give benzaldehyde, 2-picoline, and CO_2. The ratio of the competing processes is sensitive to the incorporation of deuterium at appropriate sites in the reactants, thereby permitting a convenient method for determining hydrogen isotope effects. For rearrangement, a primary kinetic isotope effect value (3.8 to 4.2) is obtained when reactions of methyl-deuterated and undeuterated 2-picoline N-oxide are compared, confirming earlier work on related systems that anhydro base formation is rate determining. Oxidation, however, manifests an inverse isotope effect (0.76 to 0.81, deuterium labeling at the methylene groups of phenylacetic anhydride) which, along with other evidence, suggests reversible enol or enolate formation prior to an SN1'-like rate-determining step to generate the reactive carbocation or its conjugate base. Solvent polarity also significantly, but not dramatically, affects the ratio of the competing pathways. A trend is established which supports the proposed mechanisms if they are modified to include ion pairing phenomena. Furthermore, the influence of solvent polarity was found to be consistent with a dual mode of fragmentation of the anhydro base intermediate. (auth)

16643 EQUATION OF STATE AND TABLES OF THERMODYNAMIC PROPERTIES OF HEAVY WATER IN THE LIQUID PHASE. Aleksandrov, A. A.; Khasanshin, T. S. (Moscow Energy Inst.). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 3, 96-101(1974). (In Russian).

The equation of state for heavy water in the liquid phase is elaborated on the basis of new experimental data on specific volumes. The equation has the form, $\nu = \kappa(T) \cdot \nu_{H_2O}(P,T)$, where $\kappa(T)$ is the ratio of specific volumes of heavy and ordinary waters at identical temperatures and pressures; $\nu_{H_2O}(P,T)$ is the equation of state of ordinary water which is a part of the International Formulation for scientific and general use (subregion I). Function $\kappa(T)$ is approximated by a polynomial of the 5-th degree on $\tau = T/100$, where T is temperature, K in MST-68. The equation of state is valid at temperatures 20 to 260°C up to 1000 bars, and at a temperature of 300°C and up to 400 bars. Values for specific volumes, enthalpy, and entropy were calculated for the above mentioned region. (auth)

16644 APPLICATION OF CHEMICAL IONIZATION MASS SPECTROMETRY TO THE STUDY OF STEREOSELECTIVE IN VITRO METABOLISM OF 1-(2,5-DIMETHOXY-4-METHYLPHENYL)-2-AMINOPROPANE. Weinkam, R. J.; Gal, J.; Callery, P.; Castagnoli, N. Jr. (Univ. of California, San Francisco). Anal. Chem.; 48: No. 1, 203-209(Jan 1976).

The stereoselective metabolism of the chiral psychotomimetic amine 1-(2,5-dimethoxy-4-methylphenyl)-2-aminopropane was studied using direct sample insertion isobutane chemical ionization mass spectrometric analysis of incubate extracts with the aid of deuterium labeled compounds as substrates and internal standards. Information was obtained on deuterium isotope effects, stereoselective substrate disappearance and metabolite formation. Mass spectrometric identification of 8 metabolites is reported for each enantiomer. Quantitative estimations of 16 incubate constituents was achieved by total ion current summation during the exhaustive evaporation of the incubate extracts into the ion source. The results suggest that direct sample insertion CIMS is an effective technique for the initial analysis of in vitro metabolic reactions. (auth)

Isotope Exchange and Isotope Separation

16645 EFFECTS OF METAL IONS ON RATES OF DETRITIATION. New Probe in the Study of Metal-Substrate Interactions. Buisson, D. H.; Jones, J. R.; Taylor, S. E. (Univ. of Surrey, Eng.). J. Chem. Soc. (London), Chem. Commun.; No. 20, 856 (22 Oct 1975).

The rate retarding effect of metal ions ($Cu^{2+} > Zn^{2+} \simeq Ni^{2+} \gg MeHg^{+}$) on isotopic hydrogen exchange from the C(2) position of imidazole can be rationalized in terms of complex formation; the stability constants can be evaluated from the exchange rate constants. (auth)

16646 KINETICS OF NONEQUILIBRIUM CHEMICAL REACTIONS AND SEPARATION OF ISOTOPES. Basov, N. G.; Belenov, E. M.; Isakov, V. A.; Markin, E. P.; Oraevskii, A. N.; Romanenko, V. I.; Ferapontov, N. B. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 68: No. 6, 2032-2037(Jun 1975). (In Russian)

A method is considered for separating isotopes in chemical reactions taking place under thermodynamically nonequilibrium conditions. Enrichment of the nitrogen oxidation products with ^{15}N in a pulsed electric discharge is obtained at various temperatures of the gas mixture. Separation coefficients of respectively ~3, 20, and 130 are attained on cooling of the reactor to room temperature, temperature of dry cold, and temperature of liquid nitrogen. (auth)

16647 EFFECT OF CLEANING THE SURFACES OF NICKEL AND PLATINUM ON THEIR CATALYTIC ACTIVITY IN HYDROGEN–DEUTERIUM ISOTOPIC EXCHANGE. Kharson, M. S.; Kiperman, S. L. (Inst. of Organic Chemistry, Moscow). Int. Chem. Eng.; 15: No. 4, 724-726(Oct 1975).

The catalytic activity of nickel and platinum in H_2/D_2 exchange was investigated as a function of thermal treatment, degree of evacuation, and blocking of the catalyst surface. (auth)

16648 ADSORPTION AND COADSORPTION IN THE SYSTEMS IRON/NITROGEN, HYDROGEN, DEUTERIUM MASS SPECTRA, DESORPTION SPECTRA, ISOTOPE MEASUREMENTS AND RESISTIVITY CHANGES. Borgmann, D. Erlangen; Erlangen-Nuernberg Univ. (1972). 121p. (In German). INIS.

Thesis.

The adsorption and coadsorption of nitrogen, hydrogen and deuterium at 77°K is investigated on iron films evaporated at 77°K under ultra-high vacuums conditions. The resistivity changes of the iron films occurring with the adsorption are recorded and the exchange reactions arising with the coadsorption are mass spectrometrically determined by analysis of the gas phase. Furthermore, thermal desorption spectra of the investigated adsorption systems are recorded and the desorbing gases are continuously analyzed with a quadrupole mass filter. (DE)

Feed Materials Processing

Refer also to abstract 17169.

16649 STUDIES ON THE CALCINATION OF AMMONIUM URANATE WITH SPECIAL REFERENCE TO SURFACE AREA. Farah, M. Y.; El-Fekey, S. A. (Atomic Energy Establishment, Cairo). Acta Chim. Acad. Sci. Hung.; 85: No. 4, 383-387(1975).

Thermal decomposition of thin layers of washed ammonium uranate of 0.3 cm thickness, up to 350°C leads to a rapid increase in the surface area of UO_3 powder; in thick layers self-reduction starts while surface area increases but to a lower extent. Above this temperature sintering leads in both cases to a reduction in surface area. However, washing prior to thermal decomposition using ethanol, acetone as also degassing of uranates, and further the temperature range of the calcination and thickness on trays are found to effect markedly surface areas of the powders formed. (auth)

Radiation Chemistry

Refer also to abstracts 16689, 17605, 17868–17870, and 17891.

16650 (AD/A-008251) GAMMA RAY AND PROTON RADIOLYSIS OF SOLID INORGANIC IONIC SALTS WITH COMPLEX ANIONS. Oblivantsev, A. N.; Lykhin, V. M.; Boldyrev, V. V.; Eremin, L. P.; Komarov, V. F. Translated from Izv. Tomsk. Politekh. Inst.; 176: 122-127(1970). 9p. (FSTC-HT-23-911-73). NTIS $3.25.

Studies were made of the radiation-chemical stability of azides and perchlorates of alkali metals subjected to gamma radiation, as well as nitrates, azides and perchlorates of alkali metals bombarded by protons at 4.7 MeV. The stability was estimated from the accumulation of products of radiolysis with a dose defined by chemical analysis, and the initial radiation-chemical yield was calculated from it. (GRA)

16651 (AD/A-008268) GAMMA AND PROTON RADIOLYSIS OF SOLID INORGANIC IONIC SALTS WITH COMPLEX ANIONS. Oblivantzev, A. N.; Lykhin, V. M.; Boldyrev, V. V.; Eremin, L. P.; Komarov, V. F. Translated from Izv. Tomsk. Politekh. Inst.; 122-127(1970). 14p. (FSTC-HT-23-0163-75). NTIS $3.25.

The radiochemical stability of azides and perchlorates of alkali metals under the action of gamma radiation and of nitrates, azides, and perchlorates of alkali metals during irradiation with 4.7 MeV protons is studied. During gamma-irradiation the distraction of the anions was shown to depend on free volume and energy of crystal lattice. (GRA)

16652 SYSTEM FOR THE REMOVAL OF PARTICULATE MATTER FROM INDUSTRIAL GASEOUS WASTES. (to Environmental Master Systems, Inc.). Netherlands Patent 7,402,009/A/. 14 Feb 1974. 14p. (In Dutch)

A system for the removal of particulate matter from gaseous industrial wastes is presented, where ionization by a radioactive source (cobalt-60 or mixed fission products) replaces the system used in Cottrell apparatus. The shielded ionization chamber is mounted in front of the electrostatic precipitator. (NL)

16653 FORMATION OF A CHARGE TRANSFER COMPLEX IN THE PULSE RADIOLYSIS OF n-ALKYL KETONES. Borisenko, G. L.; Bakh, N. A. (Inst. of Electrochemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 173-176(1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 198-202(1975).

The effect of positive (water, anthracene) and negative (oxygen, anthracene) charge scavengers on the transient absorption spectra observed in the pulse radiolysis of acetone, methyl ethyl ketone, and methyl butyl ketone was investigated. It was found that charged species are stabilized in the form of a complex possessing a number of the attributes of a charge transfer complex. (auth)

16654 EFFECT OF TEMPERATURE ON THE RECOMBINATION OF ION-ELECTRON PAIRS FORMED IN THE RADIOLYSIS OF n-HEXANE. II. Ion Pair Distribution Function Over the Initial Ion–Electron Distances. Arshakuni, A. A.; Byakov, V. M.; Pichuzhkin, V. I.; Saraeva, V. V. (Moscow State Univ.). High Energy Chem. (USSR) (Eng . Transl.); 9: No. 3, 177-179 (1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 203-206(1975).

Within the framework of the theory of isolated ion–electron pairs results on the effect of temperature on the ratio D/k_s (D is the sum of the diffusion constants of charges in a pair, k_s is the rate constant for the reaction of an electron with a scavenger) are compared on the assumption that the equation for the distribution of ion pairs with respect to the initial ion–electron distance takes the form of a Gaussian or a delta function. It is shown that the distribution in the form of a delta function leads to the same dependence of D/k_s on temperature as the Gaussian function. On the basis of the results obtained, and using known values of the electron mobility in n-hexane, the rate constant for electron capture by 1-chloroheptane was calculated to be $1.0 \cdot 10^{10}$ $M^{-1} \cdot sec^{-1}$ at –78°C and $7.6 \cdot 10^{11}$ $M^{-1} \cdot sec^{-1}$ at 59°C. (auth)

16655 REACTIONS OF HEPTYL RADICALS IN THE CONDENSED PHASE. Pichuzhkin, V. I.; Arshakuni, A. A. (Moscow State Univ.). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 180-182(1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 207-210(1975).

A study of the disproportionation and recombination reactions, and reactions with solvent molecules, of heptyl radicals formed by the radiolysis of solutions of 1- and 3-chloroheptanes in n-hexane has shown that the ratio of the rate constants of the disproportionation and recombination reactions (k_d/k_r) in the liquid phase increases with increasing temperature. It was found that for heptyl radicals the change in k_d/k_r between –196 and 85°C is described satisfactorily by the equation: $\lg(k_d/k_r) = \alpha\Delta S + b$, where ΔS is the difference in the entropies of the disproportionation and recombination products, α and b are constants. (auth)

16656 PRIMARY PRODUCTS OF THE RADIOLYSIS OF LIQUID AMMONIA. Khaikin, G. I.; Zhigunov, V. A. (Inst. of Electrochemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 183-185(1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 211-213(1975).

In the pulse radiolysis of liquid ammonia two absorption bands in the visible and UV regions were detected. The band maxima occur at 620 and 340 nm and do not shift on changing the temperature from 203 to 253°K. The decay kinetics of the particles are not described by simple equations for first or second order reactions. At T = 203°K and a dose per pulse of $2.7 \cdot 10^{18}$ eV/ml the half-lives are 10 μsec (620 nm) and 2 μsec (340 nm). It is suggested that the band at 620 nm is due to the amine radical (NH_2), the principal oxidizing species in the radiolysis of liquid ammonia, while the band at 340 nm is ascribed to the imine radical (NH), with a yield of the order of 0.1 particles/100 eV. (auth)

16657 STUDY OF THE SCAVENGER PROPERTIES OF STABLE IMINOXYL RADICALS IN THE LIQUID-PHASE RADIOLYSIS OF n-OCTANE. Romantsev, M. F.; Batyuk, S. A. (All-Union Scientific-Research Inst. of Petroleum Refining, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 186-189 (1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 214-217(1975).

Measurement of the hydrogen and nitrogen yields from the radiolysis of the systems 2, 2, 6, 6-tetramethylpiperidinoxyl-1 (RNÔ) + octane and RNÔ + octane + N_2O showed that RNÔ is an electron scavenger. The stationary state method was used to evaluate the rate constant ratio for the reactions of RNÔ and N_2O with electrons. (auth)

16658 INITIAL STEPS IN THE LIQUID-PHASE OXIDATION OF CYCLODODECANE BY MOLECULAR OXYGEN INDUCED BY γ-RADIATION. Ladygin, B. Ya.; Brul, O. I.; Samokhina, L. E.; Ledeneva, N. V. (State Scientific-Research and Planning Inst. for the Nitrogen Industry and Organic Synthesis Products, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 190-193(1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 218-221(1975).

The γ-radiation induced oxidation of cyclododecane by molecular oxygen in the liquid phase was studied. It was confirmed that cyclododecyl hydroperoxide is the principal primary product in the temperature range 120-140°C, with an activation energy for its formation of 15 kcal/mole. The catalytic hydrogenation of the peroxide to cyclododecanol and cyclododecanone is more important than its thermal decomposition. (auth)

16659 RADIOLYTIC OXIDATION OF 3-PICOLINE. Onopko, T. V.; Saraeva, V. V. (Moscow State Univ.). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 194-198(1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 222-227(1975).

A study of the radiolytic oxidation of 3-picoline in the range from –10 to 138°C has shown the existence of two temperature regions. From –10 to 40-70° nonchain reactions occur; from 40-70 to 138° chain reactions with second order termination take place. Favorable conditions for chain propagation processes are attained using dose rates which are not too high. At 125° yields of oxidation products of ~67 and ~140 molec/100 eV were obtained at dose rates of $1 \cdot 10^{15}$ and $1.4 \cdot 10^{14}$ eV/ml · sec, respectively. Further thermal oxidation of radiation-oxidized 3-picoline leads predominantly to the formation of nicotinic acid and the N-oxide of 3-picoline. (auth)

16660 GAMMA-RADIOLYSIS OF NITRATE SOLUTIONS. I. Neutral $NaNO_3$ Solutions. Kulikov, I. A.; Vladimirova, M. V. High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 199-202 (1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 228-231(1975).

The γ radiolysis of deaerated and aerated neutral solutions of $NaNO_3$ (10^{-3}-5 M) was investigated. It was found that $G(NO_2^-)$ depends on the purity of the water used in preparing the solutions and on the amount of energy absorbed. As $[NO_3^-]$ is increased from 10^{-2} to 0.1 M $G(-H_2O)$ increases from 4.0 to 4 4 molec/100 eV. (auth)

16661 PULSE RADIOLYSIS STUDY OF THE OPTIMUM CONDITIONS FOR THE OCCURRENCE OF CHAIN PROCESSES. Nikiforov, N. N.; Frunze, T. A.; Shubin, V. N.; Dolin, P. I. (Inst. of Electrochemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 203-205(1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 232-234(1975).

Aqueous solutions of isopropyl alcohol saturated with nitrous oxide were studied by the methods of pulse radiolysis, using spectrophotometric detection of the transient species formed, and by irradiations in the stationary regime; the results were compared. The effects of pH and the reagent concentrations on the optical absorption were investigated. (auth)

16662 MECHANISM OF THE REACTIONS OF α-HYDROXYISOPROPYL RADICALS WITH FERROUS IONS. Pribush, A. G.; Brusentseva, S. A.; Shubin, V. N.; Dolin, P. I. (Inst. of Electrochemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 206-208(1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 235-237(1975).

An investigation was carried out of the spectral and kinetic characteristics of the transient particles formed in aqueous solutions of isopropanol containing added ferrous ions on irradiation with pulses of fast electrons. It was found that the reaction of Fe^{2+} aquo-ions with $(CH_3)_2COH$ radicals leads to the formation of $Fe(H_2O)R^{2+}$ complexes. A spectrum ascribed to the complex was obtained, with a measured rate constant for its formation of $2.9 \cdot 10^6$ liter/mole · sec. (auth)

16663 RADIOLYSIS OF WATER: ETHYLENE GLYCOL BINARY MIXTURES. Vetrov, V. S.; Kalyazin, E. P.; Petryaev, E. P. (Inst. of Nuclear Energetics, Minsk). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 209-211(1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 238-241(1975).

The γ-radiolysis of binary mixtures of water and ethylene glycol was investigated. The radiation-chemical yields of acetaldehyde, glycol aldehyde, succinaldehyde, and formaldehyde were determined. It was found that the yields of acetaldehyde, glycol aldehyde, and formaldehyde are characterized by a positive deviation from the additive values corresponding to the electron fraction of ethylene glycol present. In an alkaline medium the formaldehyde yield increases, the glycol aldehyde yield decreases. The results are explained both by radical reactions and by the possible decomposition of ionized ethylene glycol molecules formed either directly or as a result of indirect ionization by H_2O^+. (auth)

16664 RADIOLYSIS OF ALKALINE AQUEOUS SOLUTIONS OF ETHYLENE GLYCOL IN THE PRESENCE OF NITROUS OXIDE. Kartasheva, L. I.; Pikaev, A. K. (Inst. of Physical Chemistry, Moscow). High Energy Chem. (USSR) (Engl. Transl); 9: No. 3, 212-215(1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 242-246(1975).

In a study of the radiolysis of alkaline aqueous solutions of ethylene glycol in the presence of nitrous oxide, measurements were made of the radiation yields of acetaldehyde, formaldehyde, succinaldehyde, nitrogen, and hydrogen as a function of the ethylene glycol concentration, solution pH, and dose rate. Acetate was also detected. The yields of carbonyl compounds, nitrogen, and acetate depend on the glycol concentration, pH, and dose rate. The yields of acetaldehyde, formaldehyde, and nitrogen are characterized by high values. For example, in a 1 M solution of ethylene glycol containing 0.1 M KOH and saturated with N_2O, the acetaldehyde yield is 190 molec/100 eV (dose $5 \cdot 10^{17}$ eV/ml, dose rate $2 \cdot 10^{14}$ eV/ml·sec). At higher alcohol concentrations $G(CH_3CHO)$ is even higher. A chain mechanism is proposed for the formation of carbonyl compounds in which the $CH_2 = CO^-$ ion-radical appears to play an important part. The relative rate constants of several reactions are calculated. (auth)

16665 MECHANISM OF THE RADIOLYSIS OF FROZEN AQUEOUS SOLUTIONS OF NITRIC ACID. Belevskii, V. N.; Bugaenko, L. T. (Moscow State Univ.). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 216-220(1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 247-251(1975).

The NO_2 and NO_3 radicals were observed by the ESR method in glassy 6-15 M HNO_3 solutions γ-irradiated at −196°C. In 12 M HNO_3 the maximum yields were $G(NO_2) = 8$, $G(NO_3) = 4$. The NO_3 radicals are formed by the direct and indirect action of the radiation. The indirect action occurs by means of the precursors (X) of stabilized OH radicals. By extrapolating $G(NO_3)_{ind}$ to $[HNO_3] = 0$ it was found that $G(X) = 5 \pm 1$. Additions of HCl and n-propanol reduced $G(NO_3)$. Calculations of rate constant ratios gave: $k(X^+Cl^-)/k(X^+NO_3^-) = 4.4 \pm 1.2$ and $k(X^+$n-propanol$)/k(X^+NO_3^-) = 24 \pm 3$. The NO_2 radicals are formed via the reactions of electrons. $G(NO_2)$ in an acid medium is three times greater than $G(NO_3^-)$ in a neutral medium. It is concluded that the additional amount of NO_2 is formed via excited water molecules. (auth)

16666 RADIATION CHEMISTRY OF FROZEN POLAR SYSTEMS. I. Precursors of Stabilized OH Radicals in Aqueous Solutions. Belevskii, V. N.; Belopushkin, S. I.; Bugaenko, L. T. (Moscow State Univ.). High Energy Chem. (USSR) (Engl. Transl.); 9: No. 3, 221-226(1975).

Translated from Khim. Vys. Energ.; 9: No. 3, 252-258(1975).

The ESR method was used to show that additions of NO_3^-, Cl^-, and Br^- in the concentration range 0.1-2 M efficiently suppress the formation of OH_{stab} in glassy solutions of 8 M $HClO_4$ and 8 M $NaClO_4$ γ-irradiated at −196°C. Methanol and isopropanol (0.5-5 M) decrease the Cl_2^- yields in 8 M HCl γ-irradiated at −196°C. The effect of anions decreases in the series $Br^- > Cl^- > NO_3^-$ and does not depend on the acidity of the medium. Isopropanol has a stronger effect than methanol. Solutes apparently are oxidized by H_2O^+ holes and not by OH radicals. (auth)

16667 INFLUENCE OF CYCLIC STRUCTURE ON THE RADIOLYSIS OF HYDROCARBONS. III. Radiolysis of Cyclopropane, Cyclobutane, and Cyclobutene. Horvath, Z.; Foldiak, G. (Inst. of Isotopes, Budapest). Acta Chim. Acad. Sci. Hung.; 85: No. 4, 417-435(1975).

Except for a few recent papers, the radiation chemistry of cyclopropane, cyclobutane and cyclobutene has not been investigated. The authors have established that the $G(H_2)$ values of cyclobutane and cyclobutene are extraordinarily low as compared with those of the corresponding aliphatic alkanes and higher cycloalkanes; their values are near to the $G(H_2)$ values of propene and butene, respectively, as well as to those of higher cycloalkenes. The values of G(fragment) of cyclic C_3 and C_4 hydrocarbons are considerably higher than those of $G(H_2)$. A marked tendency to ring opening can be observed in three- and four-membered carbon rings as compared with higher cycloalkanes and cycloalkenes. Thus, owing to the high strain energy, a higher fraction of the radiation energy is used for ring fission than for hydrogen elimination. The results show that the molecular structure plays a decisive but complex role in radiation chemical reactivity; e.g., cyclobutane is more reactive than cyclobutene and cyclopropane although the latter compounds possess higher strain energies. (auth)

16668 MODE OF REACTION OF O^- RADICAL WITH AROMATIC SYSTEMS. Neta, P.; Schuler, R. H. (Carnegie-Mellon Univ., Pittsburgh). Radiat. Res.; 64: No. 2, 233-236(Nov 1975).

The rate constants for reaction of O^- with a number of substituted benzenes and toluenes have been measured. While the values for abstraction from the methyl group of the toluenes (k approximately 10^9 M^{-1} sec^{-1}) are considerably greater than for addition to the ring (k less than 10^8 M^{-1} sec^{-1}) they are not strongly influenced by additional substitution. The dependence of rate constants on the substituents indicates that O^- is less electrophilic than is OH. The reaction of O^- with phenols and anilines is also quite rapid (k approximately 10^9 M^{-1} sec^{-1}), indicating that in these cases reaction takes place via electron transfer and not addition. (auth)

16669 RATE CONSTANTS FOR THE REACTION OF OH RADICALS WITH CHF_2Cl, CF_2Cl_2, $CFCl_3$, AND H_2 OVER THE TEMPERATURE RANGE 297 TO 434°K. Atkinson, R.; Hansen, D. A.; Pitts, J. N. Jr. (Univ. of California, Riverside). J. Chem. Phys.; 63: No. 5, 1703-1706(1 Sep 1975).

Rate constants for the reaction of OH radicals with CHF_2Cl, CF_2Cl_2, $CFCl_3$, and H_2 were determined over the temperature range 297 to 434°K using a flash photolysis–resonance fluorescence technique. The following Arrhenius expressions were obtained: $k_1(CHF_2Cl)$ equals 1.21 x 10^{-12}e/sup -(3250 ± 300)/RT/ cm^3 $molecule^{-1}$ sec^{-1}, $k_1(CF_2Cl_2)$ less than 1 x 10^{-15} cm^3 $molecule^{-1}$ sec^{-1} (T equals 297 - 424°K), $k_1(CFCl_3)$ less than 1 x 10^{-15} cm^3 $molecule^{-1}$ sec^{-1} (T equals 297 to 424°K), $k_1(H_2)$ equals 5.9 x 10^{-12} e/sup -(3990 ± 300)/RT/ cm^3 $molecule^{-1}$ sec^{-1}. The rate constants for the reaction of OH radicals with H_2, which were used to check the experimental system, are in good agreement with literature values. The atmospheric significance of the reaction of OH radicals with CHF_2Cl is briefly discussed. (auth)

16670 REACTIONS OF SOLVATED ELECTRONS WITH SOLUTES AT HIGH CONCENTRATIONS. A Laser Photolysis and Pulse Radiolysis Study. Bromberg, A.; Thomas, J. K. (Univ. of Notre Dame, IN). J. Chem. Phys.; 63: No. 5, 2124-2130(1 Sep 1975).

Solvated electrons were produced in several liquids by laser photoionization of aromatic solutes, and by pulse radiolysis. The yields of solvated electrons were decreased by high concentrations (0.1 - 1.0M) of phenol, benzene, and ethyl acetate; the effectiveness of the solutes in reducing the e^-/sub s/ yields was greater in the photolysis experiments than in the corresponding pulse radiolysis experiments. The data were, however, identical with light of wavelength 3471 or 2650 A, from ruby and neodymium lasers, respectively. The data are used to discuss several theories. Solvated electrons in alcohols were photobleached with red light (lambda equals 6942 A) giving H atoms. The quantum yield for the process was found to be low. (auth)

16671 FORMATION OF ATOMIC HYDROGEN DURING RADIOLYSIS OF GASEOUS AMMONIA. Dzantiev, B. G.; Ermakov, A. N.; Molokanova, T. A.; Lomako, L. T. (Inst. of Chemical Physics, Moscow). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 2, 41-48(1974). (In Russian).

Radiolysis of binary mixtures of ammonia–ethylene, ammonia–propylene and ammonia–dimethylamine was studied to determine primary radiation output during decomposition of gaseous ammonia by radiolytic methods. The value of the primary radiation output of hydrogen atoms when gaseous ammonia radiolysis is taking place was equal to 8 ± 0.6 molecules/100 eV. It was obtained by three independent methods: on the output of ethyl radicals recombination and disproportion products in the ammonia–ethylene system, concentration dependence of olefin decomposition in this system, and the data on molecular hydrogen output in the ammonia–dimethylamine system. (auth)

16672 EFFECT OF TEMPERATURE ON THE RADIOLYSIS OF N_2O_4 IN FAST REACTORS. Nesterenko, V. B.; Nichipor, G. V.; Ukraintseva, L. V. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 2, 29-36 (1974). (In Russian).

The effects of temperature on radiolysis of gaseous nitrogen tetraoxide in fast reactors in regard to radical mechanisms were studied. Energy transfer is assumed to be negligible. Data were obtained with ECM "Minsk-22". (auth)

16673 FORMATION OF AMINE RADICALS DURING THE RADIOLYSIS OF GASEOUS AMMONIA. Dzantiev, B. G.; Ermakov,

A. N.; Lomako, L. T.; Molokanova, T. A. (Inst. of Chemical Physics, Moscow). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 3, 36-41(1974). (In Russian).

The γ radiolysis of binary mixtures of ammonia with simple olefins (C_2H_4, C_3H_6) in the temperature range of −20 to +20°C and olefin concentration in 10^{-3} to 50% volume mixture was studied to determine the value of the primary yield of amine radicals in radiolysis of gaseous ammonia, which was found to be 8.6 ± 1.2 per eV. (auth)

16674 SINGULARITIES OF THE CARBOXYLATION OF AQUEOUS SOLUTIONS OF ALIPHATIC AMINES UNDER THE EFFECTS OF n,γ RADIATION. Zhigunova, L. N.; Manuilova, G. B.; Petryaev, E. P. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energy. Navuk; No. 3, 33-35(1974). (In Russian).

In the carboxylation of aqueous solutions of amines (methylamine, trimethylamine, pentane amine) a complex mixture of amino acids is formed under the action of radiation of ^{60}Co as well as of n,γ radiation of a nuclear reactor. The formation of a polymeric compound is the feature of carboxylation under the action of n,γ radiation of a nuclear reactor in the dose range 1 to $9 \cdot 10^{22}$ eV/ml. Hydrolysis of the polymeric compound indicated the presence of amino acids as the basic products of the carboxylation. (auth)

16675 ELECTRON TUNNELLING IN GLASSY MEDIA. Gamma-Radiolysis Investigation of Electron Scavenging in Methanol, 2-Methyltetrahydrofuran and 10 Mole dm^{-3} Hydroxide Glasses at 770°K. Marshall, E. J.; Pilling, M. J.; Rice, S. A. (Oxford Univ.). J. Chem. Soc. (London), Faraday Trans., II; 71: No. 9, 1555-1562(1975).

The efficiency of electron scavenging by a range of solute molecules in methanol, 2-methyltetrahydrofuran (MTHF) and 10 mole dm^{-3} hydroxide glasses was investigated by γ-radiolysis at 77°K using spectrophotometric detection. The data were analyzed using the recent theory of Dainton, Pilling and Rice (J. C. S. Faraday II; 71: 1311(1975)), and a satisfactory fit found. The trap depths for the three systems are estimated to be 1.7 eV (methanol), 1.0 eV (MTHF) and 0.95 eV (aq. hydroxide). A wide variation in the scavenging efficiency is tentatively ascribed to the differing geometries of the scavenger molecules. For MTHF and 10 mole dm^{-3} hydroxide glasses, the efficiency of scavenging is independent of wavelength, suggesting that the width of the electron spectrum is not due to a range of trap depths. (auth)

16676 THEORETICAL MODEL FOR DIFFUSION CONTROLLED REACTIONS OF SOLVATED ELECTRONS, INCORPORATING A TUNNELLING MECHANISM. Pilling, M. J.; Rice, S. A. (Oxford Univ.). J. Chem. Soc. (London), Faraday Trans., II; 71: No. 9, 1563-1571(1975).

The effect on diffusion-controlled reactions, of electron tunnelling from a solvent cavity to a scavenger molecule, is examined. The radial diffusion equation is modified to include a sink term, which varies exponentially with distance from the origin, and thus simulates tunnelling behavior. An analytical solution is obtained for the steady-state, and applied to diffusion controlled reactions of the solvated electron in media covering a wide range of viscosities. In low viscosity media ($\eta \sim 10^{-3}$ kg m^{-1} s^{-1}) reaction can take place at a reactant separation of about two molecular diameters, this distance increases with viscosity, reaching about eight molecular diameters for $\eta = 10^{3}$ kg m^{-1} s^{-1}. The theory is also applied to energy transfer by an exchange mechanism; transfer only begins to take place from distances greater than the encounter distance when the viscosity reaches $\sim 10^{5}$ kg m^{-1} s^{-1}. (auth)

16677 ALKYLATION OF ADAMANTANE WITH ETHYLENE, INITIATED BY γ-RADIATION. Podkhalyuzin, A. T.; Vikulin, V. V.; Vereshchinskii, I. V. (Inst. of Physical Chemistry, Moscow). Dokl. Phys. Chem. (Engl. Transl.); 221: No. 1-3, 252-254 (Mar 1975).

Translated from Dokl. Akad. Nauk SSSR; 221: No. 2, 381-383 (Mar 1975).

The synthesis of ethyladamantane by alkylation of adamantane with ethylene under the influence of γ radiation from ^{60}Co is reported. Experiments were performed at various temperatures, pressures, radiation doses, and concentrations of ethylene and adamantane. Best results were obtained at elevated pressures, 330°C, and a dose rate of 84 rad/sec for a period of 12 h. The product was a mixture of 1-ethyladamantane (29.9% yield) and 2-ethyladamantane (7.1% yield). (JGB)

16678 CHANGE OF SEPARATION PROPERTIES OF AN EXTRACTION CHROMATOGRAPHIC SYSTEM AFTER GAMMA IRRADIATION WITH DIFFERENT DOSES AND DOSE RATES. Huber, M. Munich; Technische Univ. (1973). 70p (In German). INIS. Thesis.

Within the framework of the following study, the change of the chromatographic efficiency of a very frequently used extraction chromatographic system was investigated under the influence of gamma radiation of different doses and dose rates. The results showed that the separating efficiency of the system decreases as a whole with increasing dose. It could be shown in detail that the reduction of the distribution coefficients, capacity and of the separating factor, is smaller with a wetted substance than with a non-wetted substance. On the other hand, the resolution decreased less with a non-wetted substance than with a wetted substance. (DE)

16679 TRITIUM OXIDATION IN AIR UNDER THE ACTION OF ITS OWN RADIATION. Belovodskii, L. F.; Gaevoii, V. K.; Grishmanovskii, V. I.; Nefyodov, N. V. At. Energ. (USSR); 38: No. 6, 379-381(Jun 1975). (In Russian)

Experimental results on the determination of the rate of transformation of tritium into oxide under the action of its own radiation in air of 50% relative humidity and in a dry argon medium with up to 20% oxygen added are presented. 25 ± 3°C, a pressure ~700 torr, and tritium concentration $6.3 \cdot 10^{-4}$ ÷ 600 Ci/l, the initial tritium transformation rate [d(HTO)/dt] depends on its concentration (C_T) and is described by the relation: $d(HTO)/dt = 10^{-6} C_T^{\frac{1}{2}}$ Ci/l · min. (auth)

Radiochemistry and Nuclear Chemistry

16680 (CONF-750515-, pp 133-140) METHODS FOR TRAINING RADIOCHEMICAL TECHNICIANS AT ORNL. Parrot, J. R.; Nicol, R. G. (Oak Ridge National Lab., TN). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

The training of personnel to carry out radiochemical operations at ORNL is a formidable and recurrent task since repetitive, production-type operations are not involved, and programs are constantly shifting. It is essential that provisions be made for the routine retraining of personnel if they are to make effective contributions on a continuing basis. The present training methods have emerged as a result of thirty years experience in a variety of radiochemical pilot-plant programs. These programs have included operations performed in glove boxes, hot-cell manipulator work handling high-neutron-emitting isotopes, and the entire spectrum of remote solvent extraction operations. Present methods of training and the results obtained are summarized. (auth)

Hot-Atom Chemistry

16681 (COO-1617-45) HALOGEN ATOM REACTIONS ACTIVATED BY NUCLEAR TRANSFORMATIONS. Progress Report, February 15, 1975–February 14, 1976. Rack, E. P. (Nebraska Univ., Lincoln (USA). Dept. of Chemistry). Feb 1976. Contract E(11-1)-1617. 46p. Dep. NTIS $4.00.

High energy reactions of halogen atoms or ions, activated by nuclear transformations, are being studied in gaseous, high pressure, and condensed phase saturated and unsaturated hydrocarbons, halomethanes, and other organic systems. Experimental and theoretical data are presented in the following areas: systematics of iodine hot atom reactions in halomethanes, reactions and systematics of iodine reactions with pentene and butene isomers, radiative neutron capture activated reactions of iodine with acetylene, gas to liquid to solid transition in hot atom chemistry, kinetic theory applications of hot atom reactions and the mathematical development of caging reactions, solvent dependence of the stereochemistry of the ^{38}Cl for Cl substitution following ^{37}Cl (n,gamma)^{38}Cl in liquid meso and dl-$(CHFCl)_2$. A technique was also developed for the radioassay of Al in urine specimens. (JSR)

16682 HOT-ATOM CHEMISTRY OF ^{65}Zn AND ^{69m}Zn IN THE MIXED CRYSTALS OF ZINC PHTHALOCYANINE AND METAL-FREE PHTHALOCYANINE. Ikeda, N.; Kujiral, O. (Tokyo Kyoiku Univ.). Radiochem. Radioanal. Lett.; 23: No. 3, 125-130 (15 Nov 1975).

The initial retentions of ^{65}Zn and ^{69m}Zn were investigated in α- and β-mixed crystals of zinc phthalocyanine and metal-free phthalocyanine. The initial retentions increased with the increasing mole fraction of metal-free phthalocyanine. The initial retention curves for ^{65}Zn and ^{69m}Zn were parallel to each other in respective crystal modification. The results are briefly discussed. (auth)

16683 ISOTOPE EFFECT ON YTTERBIUM RECOIL ATOMS FROM NEUTRON IRRADIATED TRIS(DIPIVALOYLMETHANOTO) YTTERBIUM(III) AS STUDIED BY THE SUBLIMATION METHOD. Shirota, Y.; Sakanoue, M. (Kanazawa Univ., Japan). Radiochem. Radioanal. Lett.; 23: No. 3, 111-118(15 Nov 1975).

The chemical effects in the crystalline solid of tris-(dipivaloylmethanato)ytterbium(III) irradiated with reactor neutrons were studied by the vacuum sublimation method. The isotope effect was revealed with regard to the behavior of the recoil atoms of ytterbium, that is, the retention value of ^{175}Yb was found to be higher than those of ^{177}Yb and ^{169}Yb. (auth)

16684 RECOIL CHEMISTRY OF SOLIDS. Glentworth, P. (Leeds Univ., Eng.); Nath, A. Radiochemistry (London); 2: 74-127(1975).

The review is covered in sections entitled: hot-atom chemistry of the d-block elements (oxyanions; phthalocyanines; acetylacetonates; double, or two-centered complexes; complexes of rhenium, osmium, iridium, rhodium; organometallic compounds; complexes of cobalt, iron, chromium; Mossbauer studies of chemical effects of nuclear transformations; perturbed angular correlation studies); hot-atom chemistry of s- and p-block elements (s-block elements; p-block elements – including effects of neutron irradiation; effects of isomeric transitions and electron capture decay; ion implantation studies; gamma radiation annealing and $\gamma-\gamma'$ recoils; β decay; α decay; deuteron and high-energy proton irradiations). (UK)

Properties of Radioactive Materials

16685 APPLICATION OF THE INDICATOR-ACTIVATION-ANALYSIS TO LABEL AEROSOLS. Kuehn, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Hanover); Schultz, H.; Voelz, E. Newsletter on the Application of Nuclear Methods in Biology and Agriculture; No. 4, 12-16(May 1975).

16686 POLAROGRAPHIC BEHAVIOR OF URANYL ION IN CITRATE SOLUTIONS. Issa, I. M.; Ghandour, M. A.; Hamman, A. M.; Hassan, M. K. (Assiut Univ., Egypt). Acta Chim. Acad. Sci. Hung.; 85: No. 4, 445-454(1975).

The polarographic behavior of U(VI) in citrate solution was investigated. Two waves were observed: the limiting currents and half-wave potentials of which depend on pH. At pH < 3, the first wave corresponds to the reduction of the uranyl citrate complex, into a mixture of U(IV) and U(V) citrate complexes. The second wave which is very small at higher concentrations of citrate (>0.1 M) corresponds to the reduction of free U(V). Between pH 3 and 6, the two waves, originating from the splitting of the principal wave (first wave), are attributed to the existence of two uranyl citrate species both of which are reduced to U(V), followed by dismutation of U(V) into U(IV) and UPVI). The two waves coalesce into one at higher U(VI) concentrations. The electrode reduction processes proceed reversibly and mainly under diffusion control with partial kinetic component. (auth)

16687 INTERMOLECULAR ENERGY TRANSFER FROM UO_2^{2+} TO Eu^{3+} IN SOLUTIONS. Joshi, B. D.; Dalvi, A. G. I.; Bangia, T. R. (Bhabha Atomic Research Centre, Bombay). J. Lumin.; 10: No. 4, 261-266(May 1975).

The quenching constants for the UO_2^{2+} ion fluorescence by the Eu^{3+} ion in H_2O, D_2O, potassium formate and acetic acid media were determined by measuring the decrease in intensity of the 5050 A fluorescence peak and the lifetime of the UO_2^{2+} ion fluorescence. The energy transferred to the Eu^{3+} ion was found to be a small fraction of the energy lost by the UO_2^{2+} ion by the non-radiative processes. The variations of the quenching constants of the UO_2^{2+} ion and the fluorescence lifetimes were determined for different concentrations of potassium formate and acetic acid. These results indicate that the UO_2^{2+} ion forms inner sphere complexes with the two ligands mentioned. (NL)

16688 FLUORINE-18 LABELLED L-p FLUOROPHENYLALANINE. Goulding, R. W.; Gunasekera, S. W. (Hammersmith Hospital, London). Int. J. Appl. Radiat. Isot.; 26: No. 9, 561-564(Sep 1975).

The chemical preparation and subsequent analysis of L-p-fluorophenylalanine (^{18}F) is described. Tissue distribution of the material in rats is discussed and results compared with previous work using ^{18}F labelled DL-p-fluorophenylalanine. From the results it would appear that the best prospects for the successful application of an ^{18}F-labelled amino acid would be the use of an optically pure L-amino acid at the highest possible specific activity. (UK)

16689 USE OF RADIOACTIVE KRYPTONATES TO SOLVE SOME PHYSICOCHEMICAL PROBLEMS OF POLYMERS. IV. Kryptonation Ability of Polymers as a Means for the Study of its Properties. Harangozo, M.; Toelgyessy, J.; Dillingerova, T.; Dillinger, P.; Naoum, M. M. (Slovak Technical Univ., Bratislava). Radiochem. Radioanal. Lett.; 23: No. 3, 169-173(15 Nov 1975).

Radioactive kryptonates of irradiated and non-irradiated polyethylene, polypropylene, polymethylmethacrylate, and polyvinyl chloride were prepared by diffusion technique using different temperature of kryptonation. The kryptonation ability of these polymers was studied as a function of temperature which causes structural changes in the polymer. (auth)

16690 MOESSBAUER STUDY OF COBALT(II) CHLORIDE SOLUTIONS IN NON-AQUEOUS SOLVENTS. Afanasov, M. I. (Moscow State Univ.); Nagy, S.; Perfiliev, Yu. D.; Vertes, A.; Babeshkin, A. M. Radiochem. Radioanal. Lett.; 23: No. 3, 181-186(15 Nov 1975).

A series of cobalt(II) chloride solutions has been studied by Moessbauer emission spectroscopy. In spite of the effect of the electron scavenger properties of solvents, no correlation has been found between the Fe^{2+} yields and the dielectric constants and donicities of the solvents. (auth)

16691 PREPARATION AND CHARACTERIZATION OF NEPTUNIUM AND AMERICIUM MONOSELENIDES AND MONOTELLURIDES. Damien, D.; Wojakowski, A. (CEN, Fontenay-aux-Roses, France). Radiochem. Radioanal. Lett.; 23: No. 3, 145-154(15 Nov 1975). (In French).

The preparation and X-ray characterization of the so far unknown monochalcogenides, NpSe, NpTe, AmSe and AmTe are described. All these compounds were found to crystallize in the NaCl type of structure. (auth)

16692 $K^{18}F$ FROM REACTOR-PRODUCED FLUORINE-18. Synthesis of Ethyl 2-Fluoropropionate-^{18}F and 4-Toluenesulfonyl Fluoride-^{18}F. de Kleijn, J. P.; Meeuwissen, H. J.; van Zanten, B. (Vrije Univ., Amsterdam). Radiochem. Radioanal. Lett.; 23: No. 3, 139-143(15 Nov 1975).

A method is described for the preparation of dry and radiochemically pure $K^{18}F$ from reactor-irradiated Li_2CO_3. Using this $K^{18}F$ as fluorinating agent ethyl 2-fluoropropionate-^{18}F and 4-toluenesulfonyl fluoride-^{18}F were prepared within 175 and 125 min, respectively, after the end of irradiation. (auth)

16693 DOUBLE MOLYBDATES OF CESIUM AND THORIUM. Bushuev, N. N.; Trunov, V. K. (Moscow Inst. of Fine Chemical Tech.). Zh. Neorg. Khim.; 20: No. 5, 1233-1235(May 1975). (In Russian).

The Cs_2MoO_4–$Th(MoO_4)_2$ system was investigated by x-ray phase analysis and thermographic analysis. The parameters of the elementary cell were determined for some of the compounds obtained. (tr-auth)

16694 REACTIONS IN THE SYSTEM UO_3–WCl_6. Eliseev, S. S.; Glukhov, I. A.; Vozhdaeva, E. E.; Malysheva, L. E. Zh. Neorg. Khim.; 20: No. 5, 1447-1450(May 1975). (In Russian).

In the system UO_3–WCl_6 the exchange reactions $UO_3 + WCl_6 \rightarrow UO_2Cl_2 + WOCl_4$ and $UO_2Cl_2 + WCl_6 \rightarrow UOCl_4 + WOCl_4$ proceeds during heating in a sealed ampule at temperatures not exceeding 150°C. (tr-auth)

16695 INTERACTION OF THE TETRACHLORIDES OF URANIUM AND THORIUM WITH THE CHLORIDES OF SODIUM AND POTASSIUM. Desyatnik, V. N.; Raspopin, S. P. Zh. Neorg. Khim.; 20: No. 5, 1385-1388(May 1975). (In Russian).

The surfaces of the primary crystallizations of the ternary systems NaCl–UCl_4–$ThCl_4$ and KCl–UCl_4–$ThCl_4$ were studied by differential thermal analysis. It was shown that NaCl forms with UCl_4 and $ThCl_4$ two ternary eutectic and peritectic mixtures with fusion temperatures of 342 ± 2, 356 ± 2, and 356 ± 2. KCl forms with UCl_4 and $ThCl_4$ four eutectic mixtures with fusion temperatures at 340 ± 2, 332 ± 2, 320 ± 2, and 402 ± 2. (tr-auth)

16696 THERMOPHYSICAL AND MAGNETIC PROPERTIES OF TECHNETIUM OVER A WIDE RANGE OF TEMPERATURES. Sptsyn, V. I.; Zinov'ev, V. E.; Gel'd, P. V.; Balakhovskii, O. A. (Inst. of Physical Chemistry, Moscow). Dokl. Phys. Chem. (Engl. Transl.); 221: No. 1-3, 225-228(Mar 1975).

Translated from Dokl. Akad. Nauk SSSR; 221: No. 1, 145-148 (Mar 1975).

Results are given for studies on the electrical resistivity, thermal diffusivity, specific heat, magnetic susceptibility, thermo-emf, and thermal conductivity of Tc metal over the temperature range 80 to 1800°K. Results indicate that the temperature dependence for the resistivity of Tc is nonlinear, while its temperature coefficient decreases monotonically and almost linearly with temperature. It is concluded that there is a possibility of a change in the topology of the Fermi surface at high temperatures, which has not been taken into account in previous studies. (JGB)

16697 DISSOCIATION AND SOLVATION OF URANYL COMPOUNDS IN WATER-ORGANIC SOLVENTS. Ernst, S.; Jezowska-Trzebiatowska, B. (Univ., Wroclaw). Z. Phys. Chem. (Leipzig); 256: No. 2, 331-336(1975).

The phase velocities of the propagation of ultrasonic waves in solutions of UO_2SO_4 in water and water-dioxane mixtures and the densities of those solutions were measured. The adiabatic compressibilities and the hydration numbers were calculated. Some conclusions about the ion-ion interactions and the type of ion associates formed in the solutions studied were drawn. (auth)

16698 RADIOPHARMACEUTICALS. Atkins, H. L. (Brookhaven National Lab., Upton, N. Y. (USA)). Phys. Rep.; 21: No. 6, 315-367(6 Nov 1975).

The special requirements, production and utilization of radiopharmaceuticals are reviewed. The growth of nuclear medicine as a medical specialty in the past few years has coincided with the development of newer radiopharmaceuticals, particularly in kit form, to take advantage of the favorable physical and dosimetric aspects of short-lived radionuclides such as ^{99}Tc. Studies can now be performed to evaluate morphology and function of many more organs and body regions than was possible only a few years ago. These studies are performed in a non-invasive manner using the tracer principle. (NL)

16699 KINETICS AND MECHANISM OF THE OXIDATION OF URANIUM(III) BY COBALT(III) IN PERCHLORATE MEDIA. Ekstrom, A.; McLaren, A. B.; Slmythe, L. E. (Australian Atomic Energy Commission, Lucas Heights). Inorg. Chem.; 14: No. 12, 2899-2902(Dec 1975).

The kinetics of the oxidation of U(III) by Co(III) was studied in perchlorate media. The rate law of the reaction was found to be given by the expression $-d[Co(III)]/dt$ equals $k_1[Co(III)][U(III)]$. The value of k_1 was determined as $(1.12 \pm 0.1) \times 10^6$ M^{-1} sec^{-1} at 20°C and ionic strength of 2.00 and was found to be independent of acid concentration at constant ionic strength. The temperature dependence of the reaction was studied in the range 11 to 31°C, and the values of DELTA H^{2+} and DELTA S^{2+} were determined as 2.00 ± 0.25 kcal $mole^{-1}$ and -25.6 ± 0.8 cal deg^{-1} $mole^{-1}$, respectively. In common with many other reactions of Co(III), the rate constant of this reaction is much lower than expected from the very high DELTA G^0 value and plausible reasons for this observation are discussed. (auth)

Radioactive Waste Treatment

16700 TREATMENT AND SOLIDIFICATION OF RADIOACTIVE LIQUID WASTES BY NON-BOILING EVAPORATION AT NUCLEAR POWER PLANTS. Szivos, K. (Engineering Co. for Power Station and Network Design, Budapest); Lovass, G.; Liptak, L.; Hirling, J.; Pavlik, O.; Putirskaya, G.; Hardy, G. pp Paper 4.2-3, 17p. of 9th world energy conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-P4.

Radioactive liquid wastes of nuclear power plants can be concentrated into solid state by evaporation below boiling point and disposed for ultimate storage in that state at the site of a nuclear plant. The method proposed for solidification consists of passing an eddying flow of hot air in closed circuit over and along the surface of liquid water to be treated, and of recovering the water from the air flow in a vapour condenser. Concentration and ultimate storage may take place in the same tank. By this method of evaporation where water is vapourized from the surface without being boiled, good decontamination factors are ensured. Two variants are proposed for performing the procedure: (1) In the single-tank plant the heat input required for evaporation is provided exclusively by hot air circulated over the water surface, the method being suitable for concentrating large quantities of high-salt effluents into solid state after reducing their water content in boiling-type evaporators; (2) In the double-tank plant the waste tank is surrounded by an outer tank, the air saturated with vapour over the water level being led through the space between the two tanks from which additional heat is transferred to the concentrator space. The specific evaporation rate of this variant is higher, hence it is suitable for covering the entire evaporation and solidification requirement of smaller nuclear installations in a single stage, without the need for any previous concentration. (auth)

16701 MANAGEMENT OF WASTES FROM NUCLEAR FUEL REPROCESSING FOR THE PROTECTION OF MAN AND HIS ENVIRONMENT. Parker, H. E.; West, P. J. pp Paper 4.2-15, 18p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-4.

Management of nuclear wastes through 1990 including processing, storage, and disposal is discussed.

The waste management problems over this period will include the assurance of long-term control over the large mill-tailings piles throughout the world, and the isolation from the biosphere of the high-activity fission product wastes arising from the reprocessing of the irradiated nuclear fuel. The technologies that have been developed for the management of wastes arising from the nuclear fuel cycle up to the discharge of irradiated fuel from the reactor provide very adequate control of releases of radioactivity to the environment such that this contribution to population dose is only a very small fraction of that received from natural sources. The present technologies for the management of the high-level radioactive wastes from the reprocessing of fuel also assure protection of the environment by isolation of these wastes from the biosphere. Nevertheless due to the need to maintain assurance of such isolation for many thousands of years, there is a continuing challenge to technology for the development of improved techniques to meet this objective. A number of concepts to provide a permanent solution to the problem are being evaluated, of which disposal into deep geological formations, such as bedded salt, seems to offer technologically earlier application than more innovative concepts such as extraterrestrial disposal. (LK)

16702 ON THE SEPARATION OF APPLICABLE RELEVANT FISSION PRODUCT FROM WASTE SOLUTION IN THE REPROCESSING OF NUCLEAR FUELS BY MEANS OF COUNTER CURRENT ION MIGRATION. Schwarz, B. Berlin; Technische Univ. (1973). 58p. (In German). INIS.

Thesis.

The reprocessing of the waste solution of spent nuclear fuels by means of counter-current ion migration was examined using an inactive model solution with the object of obtaining the applicable relevant fission product. A process was thus developed which fits into the framework of a whole concept for the reprocessing of spent nuclear fuels by means of the same method. The strong nitric acid solutions are converted into a suitable electrolyte system for the counter-current electrolyte separation process by denitration using formic acid in the presence of acetic acid. By introducing hydrogen into the denitrated and free-from-precipitate solution, the platinum elements rhodium and palladium are precipitated. The solution is then subjected to a continuous separation into a cation and anion fraction. The technetium present in the anion fraction is separated from the molybdenum in a lewatite anion exchange column. The cation fraction containing most of the components is further split up in a discontinuous counter-current ion migration process. (DE)

Radioisotope Production

Refer also to abstracts 17505 and 17925.

16703 PREPARATION OF CARRIER-FREE RADIOACTIVE THALLIUM FOR MEDICAL USE. Comar, D.; Crouzel, C. (Service Hospitalier Frederic Joliot, Orsay, France). Radiochem. Radioanal. Lett.; 23: No. 3, 131-137(15 Nov 1975).

Radioactive thallium for medical use has been prepared by proton or deuteron bombardment of HgO or metallic Hg. The carrier-free thallium is separated from mercury by ether extraction of the chloride. The yield of production for the isotopes 198 m to 202 is given for different energies of protons and deuterons. (auth)

Reactor Fuel Reprocessing

Refer also to abstracts 16701, 17169, 17179, 17599–17603, 17902, 17903, and 19578.

16704 (CONF-750515-, pp 93-103) REGULATORY PERSPECTIVE OF SELECTING, TRAINING, AND LICENSING OF PERSONNEL FOR FUEL CYCLE FACILITIES. Clark, A. T. (U. S. Nuclear Regulatory Commission, Washington, DC). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

A guide is presented which provides general qualification requirements for the plant manager, operations manager, maintenance manager, technical managers, quality assurance manager, supervisors, professional technical staff, and technical support personnel, operators, technicians, repairmen, and temporary

personnel. Subject areas for training both licensed and unlicensed personnel are given. (auth)

16705 (CONF-750515-, pp 105-116) ATLANTIC RICHFIELD HANFORD COMPANY, CHEMICAL OPERATOR TRAINING PROGRAM. Zumhoff, R. G. (Atlantic Richfield Hanford Co., Richland, WA). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

Formal training and testing of Chemical Operators at Hanford were initiated as part of a negotiated union settlement in 1966. The training and testing program was developed in two parts. The first covered subjects of a general nature and was applicable to an operator's duties no matter what the assignment. Part II was more specifically oriented to the presently assigned work area. Renewed interest in retraining and requalification of all chemical operators was taken in 1971. This evolved from a Company concern that a program be developed to assure the fact that operators were qualified to do their assigned jobs, and an Atomic Energy Commission request for an outline of a retraining and requalification program for chemical operators. Building upon the experience gained in the LNCO (Lead Nuclear Chemical Operator) program, the two-part format is retained. The use of video tapes is used to complement the manuals. A small studio for in-house production of the video tapes is available to the training Specialists. A script is developed from a training manual by condensing the information into 20-minute presentations. Testing is also handled on a two-part basis; one test covers the fundamentals and a separate test is designed for each of the plant subjects. A walk-through examination is also performed for the plant portion. Operators are required to be requalified on emergency procedures on an annual basis and at two-year intervals in the other areas. (auth)

16706 (CONF-750515-, pp 117-132) OPERATOR TRAINING AT THE IDAHO CHEMICAL PROCESSING PLANT. Pearson, L. G. (Allied Chemical Corp., Idaho Falls). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

Classroom and on-the-job training has been conducted for the operating crews at ICPP since the beginning of plant operation in 1952. In the ensuing years, further emphasis was placed on developing a high-quality operating staff to meet the increasingly stringent operating requirements. Early in 1970, it became evident that a formal training program was essential to meet and document all the training requirements then in effect. A description is given of the program developed and implemented to meet these needs. (auth)

16707 (CONF-750515-, pp 141-151) REVIEW OF TRAINING METHODS EMPLOYED IN NUCLEAR FUEL FABRICATION PLANTS. Box, W. D.; Browder, F. N. (Oak Ridge National Lab., TN). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

A search of the literature through the Nuclear Safety Information Center revealed that 86 percent of the incidents that have occurred in fuel fabrication plants can be traced directly or indirectly to insufficient operator training. In view of these findings, a review was made of the training programs now employed by the nuclear fuel fabrication industry. Most companies give the new employee approximately 20 hours of orientation courses, followed by 60 to 80 hours of on-the-job training. It was concluded that these training programs should be expanded in both scope and depth. A proposed program is outlined to offer guidance in improving the basic methods currently in use. (auth)

16708 (CONF-750515-, pp 153-160) ALLIED-GENERAL OPERATOR TRAINING PROGRAM. Ayers, A. L.; Ebel, P. E. (Allied-General Nuclear Services, Barnwell, SC). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

All operators at Allied-General Nuclear Services are initially trained in the basic concepts of radiation and radiation protection, they are drilled in the basic technical tools needed for further training, they are instructed in the design and operation of the Barnwell Nuclear Fuel Plant, and they are introduced to the actual operations via operating procedures. This all occurs during the Before-the-Baseline training phase and then the operators move on Beyond-the-Baseline. There they physically learn how to do their job at their own pace using checklists as a guide. All operators are then internally certified. Progression is based on demonstrated ability and those that qualify go on to jobs requiring NRC licenses. Upon internal certification, retraining commences immediately and will continue in its four month, one year, and two year cycles. Current feedback from the various classes that have completed the courses and are now in the retraining program indicates that this combination of initial technical training, on-the-job training, and retraining will produce and maintain effective, safe, and efficient operators. (auth)

16709 (CONF-750515-, pp 161-170) CHEMICAL PLANT PERSONNEL TRAINING, ROCKY FLATS DIVISION, DOW CHEMICAL U.S.A. Haugum, S. E. (Dow Chemical U.S.A., Golden, CO). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

Described are training techniques used to prepare personnel for handling radioactive materials and specialized equipment. A plutonium recovery plant utilizes procedures, equipment, and facilities not normally found in other types of processing. New Chemical Process Operators require a high school degree or equivalent with no training or testing requirements, so training provides a basis for operators to work with various kinds of equipment. A Safety and Work Indoctrination Check Sheet is completed, and 12 major job assignments are studied in depth before new personnel are assigned to production shifts. The training techniques used are audio-visual intermixed with equipment displays, lectures, tours, and on-the-job training. The final goal is to advance operators in a three-year program, to prepare them for job assignments in a new plutonium recovery plant under construction, and for future environmental and energy programs which are being established. (auth)

16710 (DOCKET-50201-173) WEST VALLEY REPROCESSING PLANT. IE Inspection Report No. 75-8. (Nuclear Fuel Services, Inc., Rockville, Md. (USA)). 1 Dec 1975. 14p. Dep. NTIS $3.50.

Results of an inspection of the West Valley Processing Plant on October 20-23, 1975 are reported. The inspection consisted of selective examinations of procedures and representative records, interviews with personnel, and observations by the inspector. No items of noncompliance were observed. (LK)

16711 (DOCKET-701308-4) MIDWEST FUEL RECOVERY PLANT. Safety Evaluation Report Related to License Amendment. (General Electric Co., San Jose, Calif. (USA). Nuclear Fuels Dept.). Dec 1975. 34p. Dep. NTIS $5.00.

Results of the safety evaluation relevant to the application by General Electric to amend its materials license to receive and store irradiated fuel in the Morris operation are reported. (LK)

16712 (ICP-1081) REMOTE MAINTENANCE DEVELOPMENT, JUNE 1974—JULY 1975. Jacobs, R. T. (Allied Chemical Corp., Idaho Falls, Idaho (USA). Idaho Chemical Programs – Operations Office; Aerojet Nuclear Co., Idaho Falls, Idaho (USA). Idaho National Engineering Lab.). Oct 1975. Contract E(10-1)-1375. 33p. Dep. NTIS $4.00.

The results of the first year's effort to develop techniques and equipment for performing maintenance on the New Waste Calcining Facility (NWCF) are presented in this report. Modifications made to commercially available connectors are described, and test data from mockups using both the Bridge Crane and the PAR Manipulator systems of remote handling are discussed. The preliminary use of three-dimensional television as a remote maintenance concept is also discussed. (auth)

16713 NUCLEAR FUEL REPROCESSING EXPANSION STRATEGIES. Gallagher, J. M. Stanford, CA; Stanford University (1975). 245p. University Microfilms Order No. 75-25,529.

Thesis (Ph. D.).

A description is given of an interdisciplinary effort to apply the techniques of operations research and energy system modeling to the problem of determination of cost-effective strategies for capacity expansion of the domestic nuclear fuel reprocessing industry for the 1975 to 2000 time period. The research also deter-

mines cost disadvantages associated with alternative strategies that may be attractive for political, social, or ecological reasons. The sensitivity of results to changes in cost assumptions was investigated at some length. Reactor fuel types covered by the analysis include the Light Water Reactor (LWR), High-Temperature Gas-Cooled Reactor (HTGR), and the Fast Breeder Reactor (FBR). The major decision variables are the size, multifuel processing flexibility, location, and time-phasing of future reprocessing plants. Major strategy questions investigated include economic incentives for the extension of plant sizes beyond the current state-of-the-art, cost penalties associated with reprocessing plants sized to serve regional loads and with nuclear energy parks (integrated reactor-reprocessing complexes sized up to 10,000 MWe), transportation cost increases required to make smaller plants competitive, and cost comparisons between single-purpose (one fuel type) and multipurpose (several fuel types) reprocessing plants. The analytical approach used is to build a mathematical model of the reprocessing industry that can be employed to test the effects on the industry of various combinations of investments in new capacity and of different schedules of investment projects over time. The lowest-known cost solution under reference cost assumptions is a reprocessing capacity expansion strategy characterized by the construction of large-scale, centrally located, multipurpose facilities. An investigation of cost disadvantages of non-optimal strategies indicates the nuclear energy park concept to be the least competitive reprocessing strategy considered. Restriction of plant sizes to the current state-of-the-art size also leads to large cost disadvantages. Reprocessing all fuels in single-purpose facilities, on the other hand, suffers only slight cost penalties compared to the optimal multipurpose alternative. (Diss. Abstr. Int., B)

16714 PRESENT STATE AND FUTURE TRENDS IN NUCLEAR FUEL REPROCESSING WITH A VIEW TO ECONOMIC POWER GENERATION AND RELIABLE WASTE DISPOSAL. Couture, J. (Commissariat l'Energie Atomique, Paris); Hughes, T. G.; Zeuhlke, P. pp Paper 4.2-24, 9p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-4.

The importance of the recovery of fissile uranium and plutonium from spent nuclear fuels for the economics of nuclear power generation is generally recognized. As a result of the growth of the nuclear power industry efforts in a number of countries have led to the development of extensive technology relating to nuclear fuel reprocessing and the construction of a number of reprocessing plants capable of rendering reliable services to the utilities. With the introduction of a large number of nuclear power stations in recent years the importance of reprocessing for safe treatment and disposal of nuclear wastes has emerged more and more clearly. Reprocessing is also a most important waste treatment service to the utilities for the recovery of valuable material. The main criteria to be met in a reprocessing plant, namely environmental protection and safety, ease of operation, reliability and economics are dealt with. Reference is made to the extensive R&D effort in Europe directed to future reprocessing requirements. (auth)

CONTROLLED THERMONUCLEAR RESEARCH

16715 (ERDA-tr-66, pp 14-18) PLASMA INSTALLATIONS OF INSTITUTE OF NUCLEAR PHYSICS OF SIBERIAN BRANCH OF USSR ACADEMY OF SCIENCES. Oct 1975. Translation of Russian Paper.

In selected USSR papers on plasma physics and controlled thermonuclear fusion.

Brief descriptions are given of the following devices: GOL-1 installation, VODA pulse generator to produce a heavy-current relativistic electron beam, INAR installation, PSP-1, and PSP-2. (MOW)

16716 PHYSICS AND THE ENERGY INDUSTRY. Summer School in Physics, Bedford Park, Australia, January 1974. Bedford Park, Australia; Flinders University of South Australia (1974). 168p. (CONF-740137-).

This volume contains notes prepared by lecturers at the School; three lectures on "fission reactors" are combined, as well as two lectures on "some topics in plasma physics." Of the eight separate items, three abstracts are included for NSA and four for ERA; one item, "Conventional Electricity Generation," is indexed only for the ERDA Energy Data Base. (LMT)

For abstracts of individual papers see: 16765, 16834, and 19583.

16717 PLASMA PHYSICS INDEX. Volume 10, No. 11, 1975. Bibliography, Author Index, Subject Index. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 208p.

16718 TECHNOLOGY INDEX FOR PLASMAPHYSICS RESEARCH AND FUSION REACTORS. Volume 9, No. 11, 1975. Bibliography, Author Index, Subject Index, Appendix. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 51p.

Plasma Confinement and Heating

Refer also to abstracts 16805 and 16841.

16719 (ERDA-tr-66, pp 43-48) INVESTIGATION OF MAGNETIC AND GAS COMPRESSION IN THREE-DIMENSIONAL CUMULATING LINER. Kurtmullayev, R. Kh.; Pichugin, V. V.; Semenov, V. N.; Utyugov, E. G.; Shipuk, I. Ya. (Inst. of Atomic Energy, Moscow). Oct 1975. Translation of Russian Paper.

In selected USSR papers on plasma physics and controlled thermonuclear fusion.

The results of experimental investigation and numerical calculation of the dynamics of quasi-spherical motion of a metal sheath, which compresses a toroidal magnetic field and a gas, are presented. The given experiment and calculation simulate heating of a plasma to thermonuclear parameters at beta much greater than 1 in a three-dimensional cumulating liner. The possibility of accomplishing three-dimensional motion of an initially cylindrical metal sheath is shown experimentally. The principal aspects are: (1) the distribution law of the linear density of the liner and (2) the distribution law of an accelerating magnetic field. A toroidal field of 1 MOe with an amplification factor of 25 to 30, rate of increase of 3×10^{11} Oe/s and inertial confinement time of 5 to 10 mu s has been achieved. The inert gas pressure at the moment of cumulation reaches 10^5 atm. The three-dimensional compression coefficient is 10^3. The total efficiency of the system is 3 to 5 percent, which agrees with the calculated efficiency. Numerical simulation shows that the use of a stronger configuration of the liner wall than that in experiment and accelerating magnetic field intensity makes it possible to achieve a total system efficiency up to 30 percent and gas pressure up to 10^6 atm. (auth)

16720 (ERDA-tr-66, pp 49-53) MAIN RESULTS OF RESEARCH ON PLASMA PHYSICS AND CONTROLLED THERMONUCLEAR FUSION IN 1974–1975 IN DIRECTION OF QUASI-STEADY SYSTEMS. Kartashev, K. B. Oct 1975. Translation of Russian Paper.

In selected USSR papers on plasma physics and controlled thermonuclear fusion.

Results are presented on studies of high-frequency heating in tokamaks and stellarators. Stripping phenomena observed in tokamaks is also discussed. (MOW)

16721 (EUR-CEA-FC-774) LOCATION OF THE LOWER HYBRID HEATING ABSORPTION ZONE IN TOROIDAL DEVICES. Lallia, P. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Jun 1975. 17p. INIS.

The location of the transformation of the incident electromagnetic wave into an electrostatic plasma wave near the lower hybrid resonance can be determined by using the "warm" plasma theory. This region corresponds roughly to the linear absorption region or to the source of nonlinear waves, since there the electric field is maximum. A numerical determination of this region is made for two toroidal devices: the WEGA stellarator and the JET Tokamak. (FR)

16722 MULTIPHOTON PLASMA DRAG. Rumyantsev, A. A. (Leningrad State Univ.). Zh. Eksp. Teor. Fiz.; 69: No. 4, 1195-1202(Oct 1975). (In Russian)

A consistent quantum-mechanical calculation of the acceleration and heating of a plasma due to multiphoton free-free transitions is carried out. As a result of application of the quantum electrodynamics apparatus it is possible to estimate the limiting heating temperature of the plasma in a strong radiation field of arbitrary spectral composition. Summation over the number of absorbed quanta is performed in the expression for the accelerating force. The problem of simultaneous heating and confinement of the plasma in a radiation field is discussed. (auth)

16723 HEATING OF A PLASMA BY A POWERFUL RELATIVISTIC ELECTRON BEAM IN A STRONG MAGNETIC FIELD. Arzhannikov, A. V.; Breizman, B. N.; Vyacheslavov, L. N.; Koidan, V. S.; Konyukhov, V. V.; Ryutov, D. D. (Inst. of Nuclear Physics, Novosibirsk, USSR). Nucl. Fusion; Suppl.: 181-186(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The results of an experimental investigation into the interaction of a powerful relativistic electron beam with plasma in the INAR apparatus are presented. The relativistic electron beam had initial energy of 1 MeV, maximum injection current of 10 kA, duration of 70 ns, and diameter of 2 cm. The total beam energy at entry into the plasma was approximately 300 J. The beam was injected into the column of a hydrogen plasma 230 cm long, 8 cm in diameter, and with a density of 3×10^{14} cm^{-3}. The magnetic field had mirror-trap geometry (mirror ratio 1.7, intensity in the uniform region up to 15 kOe). In the experiments various diagnostic methods were used, making it possible to measure the beam current, the total current within the plasma, the total energy of the beam entering and leaving the plasma, and the distribution of beam current over the cross section at the plasma outlet; opposing high-energy electrons were recorded. The density of the preliminary plasma was controlled during the experiment; the energy content of the plasma was determined from diamagnetic measurements; the electron distribution function was analyzed by the method of Thomson scattering of light at 90°. From an analysis of the shape of the diamagnetic signals and distribution of diamagnetism along the length of the apparatus it was established that under the assumption of predominant electron heating, the temperature of plasma electrons in order of magnitude equals 1 keV for a plasma density of 5×10^{13} cm^{-3}. The cause of heating cannot be dissipation of the reversed current. Thomson scattering of laser radiation indicated the presence of a comparatively cold plasma component with a temperature of 25 eV. High-energy electrons moving from the opposite direction toward the beam were recorded; their appearance evidently was associated with acceleration of plasma electrons in the induction fields. Mechanisms which can provide effective heating of the whole mass of electrons under conditions in which pair collisions are minor are indicated. (auth)

16724 IMPORTANCE OF SELF-FORMING PROCESSES IN PINCH DISCHARGES FOR PLASMA HEATING AND CONFINEMENT. Kvartskhava, I. F. (Sukhumi Physico-Technical Inst., USSR); Matveev, Yu. V.; Butov, I. Ya.; Samarskii, A. A.; Kurdyumov, S. P.; Popov, Yu. P. Nucl. Fusion; Suppl.: 175-180(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The authors present experimental evidence of the importance of self-forming processes in high-current pinch discharges (lamination, self-destruction of thin plasma sheaths, repeated discharge triggering at the discharge chamber wall, vaporization of the chamber, etc.) for the heating and magnetic confinement of a plasma. They propose an experimental approach involving condensation of the working gas at the chamber wall, whereby normally undesirable self-forming phenomena become a factor

making for an improvement in the thermonuclear parameters of the discharge plasma. A high-current discharge in lithium is modelled numerically, with allowance for "secondary breakdown." This is considered in the framework of one-dimensional non-stationary equations of radiation MHD with axial symmetry. Radiative transport of energy is shown to play a significant role in the discharge dynamics. Optimum plasma compression and heating regimes are indicated. (auth)

16725 PULSED TOROIDAL SYSTEM WITH AUTOMATED CONFINEMENT CHAMBER. Es'kov, A. G.; Zolotovskii, O. A.; Kalygin, A. G.; Kurtmullaev, R. Kh.; Laukhin, Ya. N.; Malyutin, A. I.; Markin, A. I.; Proshletsov, A. P.; Semenov, V. N. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 155-161(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

This work presents experimental results dealing with some urgent problems concerning toroidal systems: shaping and heating of toroidal plasma at temperatures $T \sim 10^3$ eV, dynamics of hot toroidal plasma with elongated cross section, and means of suppressing impurities. The method chosen for solving these problems has a bearing on the following fundamental points: (1) pulsed shaping and heating of plasma configuration with closed magnetic fields; (2) conveyance of the plasma toroid to an automated quasi-stationary confinement chamber. The possibility of attaining the required configuration by rapidly re-connecting opposing magnetic fields at the ends of the system has been demonstrated experimentally. Investigations were conducted in two representative modes: without an axial conductor with purely poloidal configuration of the magnetic field, and with an axial conductor for $H_\theta \neq 0$. The lifetime of the plasma formation without the toroidal field H_θ proved to be an order of magnitude greater than the value of $\tau \sim l/v_A$, which evidently is related to peculiarities in the behavior of the magnetic field in toroidal geometry with an elongated cross section. The migration of plasma toroid shaped and heated in an impact chamber into a stationary confinement chamber has been determined according to a series of independent measurements. (auth)

16726 PLASMA CONFINEMENT IN A MULTI-MIRROR MAGNETIC FIELD. Budker, G. I.; Danilov, V. V.; Kornilov, V. A.; Kruglyakov, E. P.; Lukyanov, V. N.; Mirnov, V. V.; Ryutov, D. D. (Nuclear Physics Inst., Novosibirsk, USSR). Nucl. Fusion; Suppl.: 147-153(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

It has been shown that, with mean free paths $\lambda \simeq$ the length of the individual magnetic mirror trap (probkotron) l, the concentration ratio at the inlet and outlet of the system ceases to obey the exponential law observed in previous experiments with low densities ($\lambda \gg l$). It has been established that, with mean free paths $\lambda \sim l$, the concentration ratio is maximum, attaining a value which is numerically in good agreement with the estimate obtained theoretically for a mirror ratio K = 1.83. Apart from stationary distributions, analysis was also made of nonstationary phenomena occurring when the plasma current is switched rapidly on or off. It was demonstrated, in particular, that a stationary plasma flow through a multi-mirror configuration was established considerably after the transit times. The mechanism for forming plateaux on oscillograms was clarified, illustrating the dependence of plasma density on time. Data on plasma decay after rapid disconnection of the cesium current were analyzed. Plasma flow along a slightly corrugated field formed the subject of a separate analysis. Theoretical analysis, based on the slight density drop recorded in these experiments, yielded a satisfactory explanation for the effects observed. In conclusion, the new device GOL-1 built at the Nuclear Physics Institute to investigate multi-mirror confinement of hydrogen plasma with parameters $T \simeq 100$ eV, $n \simeq 10^{15}$ cm^{-3} is described. (auth)

16727 COMPRESSION OF A DENSE TOROIDAL PLASMA WITH A $\beta > 1$ GAS PISTON. Kurtmullaev, R. Kh.; Lunin, A. L.; Semenov, V. N. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 141-145(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The possibility of considerably reducing the total energy in a thermonuclear system with non-magnetic confinement, and also alternative methods of heating a plasma are considered. In the proposed system a plasma with a magnetic field forms a closed toroidal configuration, thereby preventing longitudinal heat losses typical of open systems. In the process the formation of the toroidal structure and initial heating up to $T \sim 1$ keV occurs at parameters normal for a gas discharge ($n_0 \sim 10^{16}$ cm^{-3}). A further improvement in the plasma parameters can be obtained by increasing the pressure of the cold confining gas. This is done either by pumping a further amount of cold gas into the plasma vessel or by compressing the plasma by means of a three-dimensional converging heavy sheath. The authors make numerical calculations of the compression dynamics of a plasma confined by gas, with allowance for cooling due to thermal conduction and radiation. The calculations show that a positive thermonuclear yield can be attained in a system with pressure $P \sim 10^3$ to 10^4 atm and dimension $L \sim 50$ to 70 cm. (auth)

16728 PLASMA HEATING WITH AN AZIMUTHALLY NON-SYMMETRICAL ION CYCLOTRON WAVE IN TOKAMAK TM-1-HF. Vdovin, V. L.; Rusanov, V. D.; Shapotkovskii, N. V. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 21-25(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

With the aid of a non-symmetrical system, an ion-cyclotron wave with m = 1 and $\lambda_z = 30$ cm was excited and identified in hydrogen, deuterium and helium in Tokamak TM-1-HF. The optimum absorption areas with respect to concentration and magnetic field were determined. In the absence of a magnetic beach, up to 200 kW HF power was introduced into the plasma. The maximum increase in nT according to the diamagnetic signal in deuterium was 2×10^{15} eV/cm^3 with a concentration $n \approx 10^{13}$ cm^{-3} and initial pressure 10^{15} eV/cm^3. An estimate of the rise in ion temperature from the carbon impurity line yielded ~80 to 90 eV. (auth)

16729 HIGH-FREQUENCY PLASMA HEATING EXPERIMENTS IN THE TOKAMAK FT-1. Golant, V. E.; Gladkovskii, I. P.; D'Yachenko, V. V.; Larionov, M. M.; Levin, L. S.; Mikhailov, E. A.; Rozhdestvenskii, V. V.; Serebrenii, G. A.; Shcherbinin, O. N. (Ioffe Physico-Technical Inst., Moscow). Nucl. Fusion; Suppl.: 27-31(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Absorption of electromagnetic wave energy at the lower hybrid resonance frequency can be used for heating plasma in toroidal traps. With the transformation of electromagnetic waves into plasma oscillations at lower hybrid resonance, an absorption mechanism is ensured, which remains highly efficient at high plasma temperatures. In the vicinity of lower hybrid resonance collisional absorption is also essential. (auth)

16730 INVESTIGATION OF THE ELECTRON ENERGY DISTRIBUTION FUNCTION AND ITS VARIATION DURING ELECTRON CYCLOTRON RESONANCE HEATING. Alikaev, V. V.; Bobrovskii, G. A.; Poznyak, V. I.; Razumova, K. A.; Sokolov, Yu. A. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 33-39(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Microwave heating on Tokamak TM-3 continues to be studied. The electron energy distribution has been examined by means of X-ray and microwave plasma diagnostics. Variations in the radiation spectra during additional heating show a region of the distribution function where interaction of electromagnetic waves is taking place, giving rise to the diamagnetic effects observed previously. (auth)

16731 MAGNETOACOUSTIC HEATING OF PLASMA IN TOKAMAK TO-1. Ivanov, N. V.; Kovan, I. A. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 41-45(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The results of experiments on the excitation and absorption of natural magnetoacoustic oscillations of the plasma column in Tokamak TO-1 as well as the influence of these oscillations on the plasma state are presented. A loop exciter connected to a fixed-frequency generator was used to achieve the HF power input to the plasma. The plasma oscillations were recorded by a magnetic probe, and the Q-factor of the plasma resonator was determined according to the signal from the probe. The Q-factor is a measure of the dissipative capacity of the plasma. The low level of absorption measured (Q-factor = 5000) is associated with ionic viscosity. Excitation of magnetoacoustic oscillations in Tokamak TO-1 is accompanied by doubling of the plasma diamagnetism, an outward shift of the plasma column, and an increase in the current of the equilibrium regulators. In addition, the temperature of the plasma ion component was observed to increase from 100 to 170 eV. This was recorded from the Doppler broadening of the carbon impurity line CV and by measuring the energy distribution of the charge-exchange atoms. Observation of particle and energy balance showed that magnetoacoustic oscillations exert a twofold influence on the plasma state. Firstly, all the dissipated energy is expended on heating the plasma ions. Secondly, the presence of oscillations results in an additional

increase in the plasma energy content due to increase in the energy lifetime of the electrons as well as increase in the diffusion lifetime of the plasma. The latter is attributable to the stabilizing effect of magnetoacoustic waves on the instability responsible for anomalous electron thermal conductivity and plasma diffusion in the Tokamak. (auth)

16732 PRODUCTION OF A HOT ION PLASMA AT THE LOWER HYBRID RESONANCE AND MEASUREMENT OF ITS PARAMETERS. Glagolev, V. M.; Dyubailov, A. G.; Krivov, N. A.; Martynenko, V. V.; Skosyrev, Yu. V. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 47-53(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Electromagnetic fields delayed along a magnetic field have been created within a plasma with the aid of a coil encircling the plasma column. When these waves were propagated transversely in relation to the magnetic field in a plasma with density rising along its radius, they were delayed in the direction of propagation. The amplitude and phase distributions of the electromagnetic fields along the radius of the plasma column were measured at different moments in time. The existence of an absorption band of these waves within the plasma was detected. The absorption band was shifted towards the outer boundary from the plasma when plasma density was increased. By four independent methods it was established that the gas-kinetic pressure of the plasma, measured according to its diamagnetism, is determined by the ion component. It was found that the energy of electrons at right angles to the magnetic field is considerably less than that of the ions. The cause of limited heating was an increase in density and energy losses in the charge-exchange process. In order to improve vacuum conditions, the coil around the plasma was placed in a metallic chamber, and the UHF plasma source used in the original experiments was replaced by a hydride-film source. This made it possible to increase the internal energy of the plasma to 3×10^{15} eV $\cdot$ cm^{-3} at a density of $(1-3) \times 10^{12}$ cm^{-3}. The mean energy of atoms leaving the plasma at right angles to the magnetic field as a result of charge exchange reached 1 keV. The region of change in plasma parameters (density and magnetic field) for which heating was observed corresponded to the linear transformation theory. Nonlinear effects could occur only in the first stage of heating, when the electric fields were strong, but plasma temperature was low. Heating efficiency was measured by a reflectometer installed in the coaxial line connecting the generator and the HF input coil to the plasma. The measurements showed that about 20% of the power generated was consumed in heating the plasma. (auth)

16733 PLASMA CONFINEMENT IN A PR-7 TRAP. Gott, Yu. V.; Ioffe, M. S.; Kanaev, B. I.; Motlich, A. G.; Pastukhov, V. P.; Sobolev, R. I. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 55-61(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The PR-7 is a minimum-B mirror trap created by a quadrupole system of stabilizing conductors. Plasma is injected by an intensive plasma-beam discharge. The range of parameters of the studied plasma is as follows: initial density $n_0 = (2-3) \times 10^{12}$ cm^{-3}, mean ionic energy $\overline{W}_i \approx 400$ eV, electron temperature $T_e = 7$-10 eV; the magnetic field in the center of the trap $B_0 = 5.0$ kOe, longitudinal mirror ratio 2.0, and transverse depth of magnetic well up to 30%. The work is directed primarily at elucidation of the reasons for the sharp increase in plasma losses which develops within a certain period following the end of injection within a decaying plasma. This effect was detected earlier in the PR-6 apparatus, and subsequently in the PR-8. Among the unanswered questions, one of the main ones is why the high-loss stage is delayed relative to the moment when injection is stopped for a period of time that is definite and easily reproducible in different experiments. The present paper establishes a number of new facts that shed light on this question: (a) It has been found that this delay coincides with the time of rearrangement of the plasma configuration from nonequilibrium, as it is obtained during injection, to equilibrium. (b) The rapid rise in plasma potential observed in the PR-7 is also fixed in time to the moment of completion of rearrangement of the plasma configuration. (c) In the transition from the initial, slow stage of decay to the stage of elevated loss, the frequency spectrum of the recorded oscillations broadens in the frequency range below the ion cyclotron frequency ω_{Bi} and, which is especially important, here the oscillations lose their periodicity, becoming highly irregular. This last fact seems significant for understanding the mechanism of elevated losses. It shows that the losses are directly connected with the development of extreme turbulence within the plasma, after it has attained MHD equilibrium. (auth)

16734 PLASMA CONFINEMENT IN THE OGRA-3 SIMPLE MIRROR TRAP IN THE PRESENCE OF A MULTI-ELEMENT FEEDBACK SYSTEM. Zhil'tsov, V. A.; Likhtenshtein, V. Kh.; Panov, D. A.; Kosarev, P. M.; Chuyanov, V. A.; Shcherbakov, A. G. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 63-69(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The Ogra-3 device is a simple magnetic mirror trap with a 2.1 mirror ratio and central magnetic field of up to 25 kG, specially constructed for conducting investigations into plasma stabilization with the aid of feedback circuits. Plasma is obtained within the Ogra-3 via injection into a vacuum of a beam of hydrogen atoms of 20 keV and intensity greater than 50 equiv. mA. The vacuum conditions assure a lifetime of around 0.1 s before charge exchange for the fast ions captured in the trap. Without special measures being taken, the plasma within the Ogra-3 is unstable with respect to hydromagnetic flute oscillations, which restrict plasma build-up near the instability threshold at densities of $(1-2) \times 10^8$ cm^{-3}. An electrostatic, 12-electrode feedback system with Fourier dimensional analysis was created to stabilize the flute instability; it suppresses the lower space modes of this instability. By using it we were able to raise the threshold density of the onset of loss 10-fold and observe excitation and stabilization of the higher modes of the flute instability. Experiments with the 12-electrode system showed that the previously detected drop in losses at positive transfer coefficients of the feedback system is not a result of stabilization of flute instability, but rather is associated with non-linear effects (namely, with a drop in the phase velocities of unstable waves and a reduction in their interaction with the confined fast ions). At the same time, these experiments demonstrated the existence of a region of stability for negative transfer coefficients. This region of stability was predicted theoretically, but was not observed in early experiments with stabilizing systems having a small number of stabilizing electrodes. An investigation was conducted and a comparison was made with the theory of plasma dispersion properties in the presence of a feedback system. In accordance with the theoretical predictions, three branches of flute oscillations were detected and their change under the influence of feedback was studied. (auth)

16735 THERMAL ISOLATION AND CONFINEMENT OF PLASMA IN THE "URAGAN" ("HURRICANE") STELLARATOR. Dikii, A. G.; Kuznetsov, Yu. K.; Pavlichenko, O. S.; Pashnev, V. K.; Perepelkin, N. F.; Suprunenko, V. A.; Tolok, V. T. (Inst. of Physics and Tech., Kharkov). Nucl. Fusion; Suppl.: 79-86 (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Experiments were completed on the three-turn stellarator-racetrack "Uragan-1" ("Hurricane-1") ($a = 10$ cm, $R = 110$ cm, $\iota(a) \approx 0.8$, $H_0 \lesssim 10$ kOe) at the Institute of Physics and Technology of the Ukrainian Academy of Sciences in Kharkov. The current and high-frequency methods for plasma heating were investigated in experiments conducted on the U-1 stellarator. Plasma with parameters close to the limits for the given apparatus was used. With the plasma density $n = (1$-$8) \times 10^{12}$ cm^{-3} the electron temperature in the case of current heating reached $T_e \lesssim 400$ eV (ion temperature $T_i \lesssim 30$ eV), and the ion temperature reached $T_i \lesssim 500$ eV (electron temperature $T_e \lesssim 50$ eV) using high-frequency techniques. In both cases the peak value of the parameter $\beta = 8\pi nT/H_0^2 \approx 10^{-3}$, and the experimental conditions basically corresponded to the "plateau" regime in terms of the neoclassical theory. Equilibrium of the plasma column, its stability (over a broad frequency range), and the behavior of the coefficients of thermal conductivity and diffusion were investigated. The experiments which were conducted along with theoretical evaluations showed the absence of noticeable effects of the disruption of plasma equilibrium under both conditions of current and hf heating. Strong instabilities, which determined the character of the main macroscopic parameters, were inherent in the current plasma: a strong anomaly in the thermal conductivity of the electrons and the diffusion of particles (from the standpoint of the neoclassical theory), and also an anomaly in the electrical conductivity of the plasma. In the plasma created using the HF method, the fluctuation level was significantly lower, and in accordance with this, the measured rates of heat loss and charged-particle loss proved to be close to those predicted by theory. Now, new helical windings permitting work with a magnetic field of up to 25 kOe have been installed; in future experiments this apparatus will be called the "Uragan-2". (auth)

16736 CONFINEMENT OF PLASMA WITH LOW COLLISION FREQUENCY IN STELLARATORS WITH SHEAR. Voitsenya, V. S.; Voloshko, A. Yu.; Solodovchenko, S. I.; Suprunenko, V. A.;

Tolok, V. T.; Shtan, A. F. (Inst. of Physics and Tech., Kharkov). Nucl. Fusion; Suppl.: 87-91(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

This is a survey of experimental research in the confinement of low-density plasma in stellarators, when diffusion is contributed to greatly by particles trapped in the helical inhomogeneities of the magnetic field (frequency range $\nu_e < \nu_{e2}$, where $\nu_e = \nu_{ee} + \nu_{ei} + \nu_{en}$, and ν_{e2} is the lower boundary of the plateau in the function of the diffusion coefficient versus the collision frequency). Only those results obtained in stellarators with a relatively large shear value are examined. The experimental data are compared with the existing theories of diffusion in systems with helical symmetry. It is shown that in all cases the measured dependences of diffusion coefficients on collision frequencies are weaker than the neoclassical theory predicts; if these dependences are given in the form $D_{\perp exp} \sim \nu_e^{-\gamma}$, then for all the investigated devices ("Proto-Cleo", "Saturn", "Vint-20" ("Helix-20"), "Spac-1", and "Heliotron D") the value of γ proves to be less than unity. An empirical correlation was found between the value of γ and the parameters of the boundary magnetic surface of the apparatus. On the basis of an analysis of the data concerning plasma confinement in the "Saturn" stellarator, it was concluded that this device (where $\gamma \approx 0.1$) in the region of low collision frequencies, at least up to $0.1\ \nu_{e2}$, the plateau-characteristic dependence of the reduced plasma lifetime on the rotational transform angle and the magnetic field is observed: $\tau/r_0^2 \sim t_0 \cdot H_0^2$ (τ is the measured confinement time; t_0 and r_0 are the angle and radius of the outer magnetic surface; H_0 is the intensity of the confining magnetic field. Possible explanations for the differences between the theory and analyzed experiments are discussed. (auth)

16737 STELLATRON: A MAGNETIC SYSTEM FOR CONTAINMENT OF CURRENT-FREE PLASMA WITH IMPROVED TOROIDAL EQUILIBRIUM. Danilkin, I. S.; Kovrizhnykh, L. M. (Lebedev Inst. of Physics, Moscow). Nucl. Fusion; Suppl.: 93-98(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Questions of the creation of a "stellatron"-type confinement configuration—a stellarator magnetic trap with a noncircular, elliptical cross-section of magnetic surfaces with high eccentricity—are discussed. Evaluations are made which show that, especially in intermediate and hydrodynamic collision frequency ranges, the coefficients of diffusion and thermal conductivity in a stellatron can amount to a value on the order of a^2/b^2 of the corresponding coefficients of toroidal systems with a circular cross-section (here, a is the minor and b the major semi-axis of the elliptical cross-section of a toroidal configuration). Examples of possible current systems capable of providing the required magnetic field configuration are given. (auth)

16738 BEAM AND HIGH-FREQUENCY HEATING OF A PLASMA IN TOKAMAK-TYPE SYSTEMS. Ivanov, A. A.; Parail, V. V.; Soboleva, T. K.; Yushmanov, P. N. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 99-107(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

A theoretical treatment is presented of non-Ohmic methods of plasma heating. The first part of the paper deals with the interaction between a plasma and a magnetoacoustic wave of fairly high amplitude and a frequency lower than that of the lower hybrid resonance. It is shown that, owing to the effects of decay and induced scattering, the magneto-acoustic wave can effectively give off its energy to electrons and ions. It is also found that such a wave can suppress long-wave drift instabilities, thereby increasing the electron energy lifetime. A two-dimensional partial numerical modelling method has been used as a basis for analysing the interaction between a fast ion-beam and a plasma. It is shown that the ion beam generates in the plasma oblique ion-acoustic oscillations whose backward action on the beam causes its angular deflection. The characteristic times of beam deflection have been determined, together with the time of establishment and shape of the stationary spectrum of ion-acoustic turbulence. (auth)

16739 STUDY OF THE FOCUSING OF HIGH CURRENT BEAMS FOR HEATING AND COMPRESSION OF A DENSE D-T PLASMA. Koba, Yu. V.; Liksonov, V. I.; Pen'kina, V. S.; Rubakov, L. I.; Sidorov, Yu. I.; Smirnov, V. P.; Sukhov, A. D.; Tarumov, E. Z. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 109-112(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

An experimental study was made on the focusing of electron beams with $v/\gamma \gg 1$ in the "Triton" and "Ural" devices. The focusing took place in diodes, with the use of a plasma channel on the axis of the accelerator gap. The channel was formed by means of conical and pin-type cathodes. Focused beams were obtained with a duration of ≃ 30-40 ns with current densities of up to 30 MA/cm², the electron energy having been as much as 600 keV at a full current of up to 200 kA and a beam energy of up to 2 kJ. The dependence of focusing on the magnitude of the accelerator gap was studied and its optimum value determined. Results are given for experiments on the focused-beam heating of an aluminium-foil target of a special form. On homogeneous irradiation of the target, it was found that cumulative jets with 0.8 mm diameter were formed. The rate of expansion of material was 1×10^6 cm/s, which corresponds to an energy contribution of ≃10 eV per atom of target material. (auth)

16740 DYNAMICS OF A PLASMA IN A MULTI-MIRROR MAGNETIC SYSTEM. Danilov, V. V.; Kruglyakov, E. P. (Inst. of Nuclear Physics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 68: No. 6, 2109-2115(Jun 1975). (In Russian).

The time behavior of a plasma in a multi-mirror system is investigated experimentally on rapid ($\tau \ll L/v_{Ti}$) pulsed switching on and off of the current. It is shown that in the case of small-scale goffering ($l < \lambda < L$) the plasma behavior quantitatively agrees with the theory of plasma confinement in a multi-mirror magnetic field. (auth)

16741 STATIONARY LANGMUIR AND ELECTROMAGNETIC WAVE SPECTRA ON HEATING OF A PLASMA BY A RELATIVISTIC ELECTRON BEAM. Breizman, B. N. (Inst. of Nuclear Physics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 3, 896-908(Sep 1975). (In Russian).

Stationary turbulence spectra are found for the case when there is a given external source (relativistic electron beam) in the plasma which excites Langmuir oscillations. The stationary state is maintained as a result of the Langmuir oscillations not being in resonance with the beam due to nonlinear interaction with each other or with the electromagnetic waves and hence the oscillations are damped due to Coulomb collisions. The mechanism of nonlinear interaction is an induced scattering of the oscillations by ions. It is shown that if account is made for interaction between Langmuir oscillations and electromagnetic oscillations, collisional dissipation of oscillations should be possible even in the case of strong supercriticality ($\gamma \gg \nu$ where γ is the instability increment and ν is the collision frequency). Consequently the conditions of applicability of weak turbulence theory to the problem of beam heating of a plasma can be considerably weakened. (auth)

16742 EVOLUTION OF THE ION ANGULAR DISTRIBUTION IN A MIRROR CONFINED PLASMA. Jacquinot, J.; Leloup, C.; Poffe, J. P.; de Pretis, M. (CEN, Fontenay-aux-Roses, France). Plasma Phys.; 17: No. 10, 715-721(Oct 1975).

Two independent measurements of the angular distribution function of a mirror confined hot ion plasma are compared. The absolute values of the kinetic pressure anisotropy from one method (fast magnetic gate) is obtained using a computation of particle trajectories in time varying magnetic fields. The agreement with the other method (fast neutral detector) is satisfactory. The anomalous behaviour of the plasma pressure anisotropy is emphasized; since no high frequency activity is detected a tentative explanation based on the influence of the variable opacity to neutrals of different phase space regions of a charge exchange dominated plasma is discussed using a 2 dimensional theoretical model; this effect, computed for the actual plasma parameters, seems to be entirely responsible for the "anomalous" plasma pressure anisotropy evolution. (auth)

16743 TWO DIMENSIONAL SIMULATION OF LOWER HYBRID RESONANCE HEATING. Emery, M. H. (Univ. of Iowa, Ames); Joyce, G.; Shohet, J. L. Plasma Phys.; 17: No. 10, 757-771(Oct 1975).

The response of a magnetized plasma to excitation by an external longitudinal electric field oscillating near the lower hybrid frequency is examined by numerical simulation. A two-dimensional, electrostatic, finite-size particle code is used with the ion motion described by standard particle-in-cell methods and the electrons simulated in the guiding-centre approximation. The guiding-centre model removes the electron mass from consideration and all time scales are measured in units of the inverse ion plasma frequency. An examination of the parameters that control the ion heating lead to the following conclusions: (1) The heating mechanism is not a collisional process. (2) The ion heating rate reaches a maximum for $\lambda \equiv k_y^2 \rho_{ci}^2 = 1$. (3) The heating rate and final temperature is improved for frequencies slightly greater than the lower hybrid frequency. (4) The ion heating is improved for low densities ($\omega_{ti}/\omega_{pi} > 1$). (5) Satellite modes appear on both sides of the dominant mode in the frequency spectrum. (auth)

16744 HOT-ION DISTRIBUTION STUDIES IN A MIRROR-CONTAINED PLASMA. Hogan, W. A.; Stetson, R. F. (Florida Atlantic Univ., Boca Raton). Plasma Phys.; 17: No. 10, 773-783(Oct 1975).

Hot-ion distributions in a mirror-contained plasma are calculated by employing computer simulation of a model which includes the effects of scattering by a background plasma containing electrons, hot and cold ions, and neutrals. Hot-ion depletion due to cooling and scattering into the loss cone is considered but the dominant loss mechanism is charge-exchange with neutrals. Hot-ion buildup to 3×10^{13} cm^{-3} resulting from 10 keV ion injection is investigated and the results are compared with experimental plasma calculations. (auth)

16745 ANALYSIS OF PHYSICAL PROCESSES IN TARGETS HEATED BY LASER RADIATION OF 200-300 J ENERGY. Afanas'ev, Yu.V.; Basov, N.G.; Volosevich, P.P.; Gamalii, E.G.; Krokhin, O.N.; Kurdyumov, S.P.; Levanov, E.I.; Rozanov, V.B.; Samarskii, A.A.; Tikhonov, A.N. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 8, 989-991 (Aug 1975).

An analysis is made of the physical processes in laser targets subjected to different heating and compression regimes. The results are given of numerical calculations for CD_2 targets of different types carried out using a program allowing for the main physical processes. It is shown that calculations predict simultaneous heating and compression of a part of a specially selected hollow spherical target. An analysis of diagnostic possibilities shows that this situation can be identified using currently available diagnostic apparatus and laser systems. (auth)

16746 TORNADO TRAPS OPERATED AS ROTATING PLASMA DEVICES. Lehnert, B. (Kungliga Tekniska Hoegskolan, Stockholm (Sweden)). Phys. Scr.; 12: No. 3, 166-167(Sep 1975).

The possibility is being discussed of creating and heating the plasma in "Tornado" magnetic traps by means of the rotating plasma technique. On account of the particular field geometry of these traps, it is likely that the critical velocity phenomenon of rotating plasmas can be avoided. (NL)

16747 CHARGED-PARTICLE ORBITS IN SHEARED MAGNETIC FIELDS; IMPLICATIONS TO DIFFUSION. Gell, Y.; Harte, J.; Lichtenberg, A.J.; Nevins, W.M. (Department of Electrical Engineering and Computer Sciences and the Electronics Research Laboratory, University of California, Berkeley, California 94720). Phys. Rev. Lett. 35: No. 24, 1642-1645 (15 Dec 1975).

Charged-particle motion across a sheared magnetic field and electrostatic wave is studied. Resonant-particle orbit widths are derived; two parametric dependences are found in the limits that the particle is near or far from the $k_{\parallel}=0$ plane, with a smooth transition between the two. The orbit widths are used to calculate diffusion coefficients in tokamak-type configurations. These predictions are confirmed by test-particle computer simulations in (x, y, v_x, v_y, v_z) coordinates employing a Monte Carlo collision operator. (auth)

16748 STABILIZATION OF A NEUTRAL-BEAM-SUSTAINED, MIRROR-CONFINED PLASMA. Coensgen, F.H.; Cummins, W.F.; Logan, B.G.; Molvik, A.W.; Nexsen, W.E.; Simonen, T.C.; Stallard, B.W.; Turner, W.C. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Rev. Lett. 35: No. 22, 1501-1503 (1 Dec 1975).

We report results of plasma confinement experiments with an auxiliary warm-plasma component flowing along magnetic field lines to suppress ion-cyclotron instabilities. The reduced plasma losses, with the lower fluctuation amplitude, permits neutral-beam buildup of a 13-keV deuterium plasma to densities as high as 4×10^{13} cm^{-3} corresponding to peak beta values of 0.4. Variation of the beam energy demonstrates that longer confinement times are achieved at higher ion energies. (auth)

16749 IMPURITY TRANSPORT IN A QUIESCENT TOKAMAK PLASMA. Cohen, S.A.; Cecchi, J.L.; Marmar, E.S. (Plasma Physics Laboratory, Princeton University, Princeton, New Jersey 08540). Phys. Rev. Lett. 35: No. 22, 1507-1510 (1 Dec 1975).

We have injected short bursts of aluminum into the adiabatic-toroidal-compressor (ATC) tokamak, and measured the time evolution of the radial distribution of highly ionized states of aluminum. The results are compared with a computer code describing neoclassical impurity diffusion. (auth)

16750 PLASMA HEATING BY LOWER-HYBRID PARAMETRIC INSTABILITY PUMPED BY AN ELECTRON BEAM. Yatsui, K.; Imai, T. (Department of Electrical Engineering, Osaka University, Toyonaka, Osaka 560, Japan). Phys. Rev. Lett. 35: No. 19, 1279-1282 (10 Nov 1975).

We study experimentally the interaction of an electron beam modulated near the lower-hybrid frequency with a longitudinally magnetized inhomogeneous plasma. At high levels of beam modulation above a certain threshold, the beam pumps the parametric decay instability into the lower-hybrid wave and ion-acoustic wave, and correspondingly plasma heating takes place rapidly. The instability threshold is determined in a parameter space. These results are compared with theory, and reasonable agreement is obtained. (auth)

Plasma Diagnostics

Refer also to abstracts 16840 and 17277.

16751 (CONF-751125-120) TRANSIENT ANALYZER. Muir, M. D. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). 1975. 14p. Dep. NTIS $3.50.

From IEEE 6th symposium on engineering problems of fusion research; San Diego, California, USA (17 Nov 1975).

The design and design philosophy of a high performance, extremely versatile transient analyzer is described. This subsystem was designed to be controlled through the data acquisition computer system which allows hands-off operation. Thus it may be placed on the experiment side of the high voltage safety break between the experimental device and the control room. This analyzer provides control features which are extremely useful for data acquisition from PPPL diagnostics. These include dynamic sample rate changing, which may be intermixed with multiple post trigger operations with variable length blocks using normal, peak to peak or integrate modes. Included in the discussion are general remarks on the advantages of adding intelligence to transient analyzers, a detailed description of the characteristics of the PPPL transient analyzer, a description of the hardware, firmware, control language and operation of the PPPL transient analyzer, and general remarks on future trends in this type of instrumentation both at PPPL and in general. (auth)

16752 (EUR-CEA-FC-773) STUDY OF A FILTER SPECTROMETER IN THE FRAMEWORK OF A NEW METHOD FOR MEASURING THE TEMPERATURE OF THERMONUCLEAR PLASMAS BY RELATIVISTIC THOMSON SCATTERING. Lasalle, J. (Association Euratom-CEA, Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Groupe de Recherches sur la Fusion Controlee; CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). Jun 1975. 62p. (In French). INIS.

A new method which greatly simplifies the number of measurements necessary for obtaining the temperature in thermonuclear plasmas, using the relativistic effects of Thomson scattering is presented. A few orders of magnitude are computed for probing the feasibility of such temperature measurements. The data used correspond to magnitudes relating to T.F.R. The characteristics of a filter equipped spectrometer are then defined in view of a double function: separation of the $\lambda > \lambda$ laser and $\lambda < \lambda$ laser spectral lines, and rejection of the parasitic residual light at 6943 A (ruby laser) scattered from the walls of the vacuum chamber. The method is envisaged for measuring J.E.T. temperatures. (FR)

16753 (FRNC-TH-582) DEVELOPMENT OF A DEVICE FOR THE COMPUTERIZED ACQUISITION AND PROCESSING OF THE PARAMETERS OF LANGMUIR ELECTROSTATIC PROBES. Biraguе-Cavallie, G. (Toulouse-3 Univ., 31 (France)). 1975. 141p. (In French). INIS.

A numerical, automatic recorder for plotting characteristics of electrical probes was realized and used for studying the macroscopic parameters of a.c., low pressure discharges in Hg-noble gas mixtures. In particular, the distribution function of electron energies was directly obtained. (FR)

16754 DETERMINATION OF THE FRACTION OF RUNAWAY ELECTRONS IN A HOT NON-MAXWELLIAN TOROIDAL PLASMA FROM THE X-RAY SPECTRUM. Abramov, V. A. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 75-78(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

An analysis is made of the influence of the choice of various approximations for the bremsstrahlung cross-section from electron collisions on the form of the bremsstrahlung spectrum and on the possibility of determining the electron temperature T_e. A numerical calculation of the x-ray spectra of a hot plasma, in the presence of a group of runaway electrons, is carried out. An exact formula is taken for the radiation cross-section, exact in the sense that relativistic effects are included, i.e. that v/c is considered to be arbitrary, although in the Born approximation $e^2/\hbar v \ll 1$. Comparing the experimentally observed bremsstrahlung spectrum with the family of curves obtained, the fraction of runaway electrons can be estimated, if the temperature of the main group of electrons is known. The influence of runaway electrons on the possibility of measuring T_e, by the method of filters,

is estimated. It is shown that the distortions caused by the runaway electrons can be considerable. (auth)

16755 ANALYSIS OF THE GEOMETRY, DYNAMICS, AND MAGNETIC STRUCTURE OF A PLASMA PINCH BY THE LASER INTERFEROMETRY METHOD. Filippov, N. V.; Ivanov, V. D.; Moiseeva, M. P.; Stepanenko, M. M.; Sukhareva, M. K. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 163-167(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The dynamics of the ultimate compression phase of the plasma focus (PF) were analysed by applying differential laser interferometry and Faraday rotation of the polarization plane. The electron density distribution and magnetic field structures in the plasma focus were determined. Maximum densities on the pinch axis were 2×10^{18} cm^{-3}, the skin layer thickness during the first compression was 1.5 mm and the characteristic stabilisation time was 200 ns. (auth)

16756 BEHAVIOR OF A METALLIC BODY IN AN ISOTROPIC COLLISIONLESS PLASMA. I. General Remarks. Lafon, J. P. J. (Observatoire de Paris, Meudon, France). Plasma Phys.; 17: No. 10, 731-740(Oct 1975).

A new method is given for the investigation of the behavior of a metallic body immersed in an isotropic collisionless plasma, in cylindrical or spherical symmetry. This method simplifies the theoretical argument as well as the analytical derivation of the formulae; moreover, it always minimises the inevitable numerical computations. It is quite general, since no approximation other than the symmetry is required and all surface effects of the collector can be taken into account. Simplified or generalized definitions of some parameters of sheath and collection theory are given and discussed; some more usual approximations in previous probe theories concerning the motion of the particles are also discussed. (auth)

16757 BEHAVIOR OF A METALLIC BODY IN AN ISOTROPIC COLLISIONLESS PLASMA. II. Effects of Partial Reflection on Particles Striking the Collector. Lafon, L. P. J. (Observatoire de Paris, Meudon, France). Plasma Phys.; 17: No. 10, 741-745(Oct 1975).

This paper is concerned with the investigation of the effects on the structure of the sheath and on the collection of particles when the collector reflects part of the particles striking it. The investigation is performed using the method stated in the previous paper. [Lafon, J. P., (1975), Plasma Phys., 17: 731-740.] (auth)

16758 PLASMA TEMPERATURE MEASUREMENTS USING AN ENTHALPY PROBE. Dresvin, S.V.; Klubnikin, V.S. (The M. I. Kalinin Polytechnic Institute, Leningrad). High Temp. 13: No. 2, 400-401 (Mar 1975).

An investigation is made of the effect of the amount of aspirated gas on the accuracy of plasma temperature measurements made by an enthalpy probe. (AIP)

16759 OPTICAL SYSTEM FOR DIAGNOSIS OF PLASMA PROCESSES. Kas'yanov, G.V.; Volkov, F.G.; Rubenko, M.I. (Moscow). High Temp. 13: No. 2, 430-431 (Mar 1975).

A remote optical system is described for use in studies of plasma processes occuring at surfaces.(AIP)

16760 SUBMILLIMETER PULSE LASER FOR DIAGNOSTICS OF OPTICALLY DENSE PLASMAS. Kutovoi, V.D.; Lesnikov, E.V.; Nikitin, N.V.; Petrov, G.D.; Samarskii, P.A. (All-Union Scientific-Reseach Institute of Physicotechnical and Radio Engineering Measurements, Mendeleevo). Sov. J. Quantum Electron. 5: No. 9, 1124-1125 (Sept 1975).

A submillimeter pulse laser emitting at λ=337 μ from a mixture of methane and nitrogen and at λ=118 μ from water vapor was constructed. The pulse repetition frequency was up to 30 Hz. A tungsten-silicon point-contact detector was used to determine the shape and duration of the laser pulses (the latter was in the range 10-50 μsec). A bolometer (described in the paper) was used in measurements of the average submillimeter power. Without optimization the power per pulse was 25 W at λ=337 μ when the pulse duration was 10 μsec but at λ=118 μ the power was 3 times lower. The laser was designed for diagnostics of optically dense plasmas. (auth)

Plasma Kinetics (General)

16761 (ERDA-tr-66) SELECTED USSR PAPERS ON PLASMA PHYSICS AND CONTROLLED THERMONUCLEAR FUSION. (Energy Research and Development Administration, Washington, D. C. (USA). Div. of Controlled Thermonuclear Research). Oct 1975. Translation of Russian Papers. 61p. Dep. NTIS $5.45.

Separate abstracts were prepared for the nine included papers. (MOW)

For abstracts of individual papers see: 15715, 16719, 16720, 16762, 16780, and 16823–16826.

16762 (ERDA-tr-66, pp 1-7) SOME RESULTS OF STUDIES ON PLASMA PHYSICS AND CONTROLLED THERMONUCLEAR FUSION IN 1974–1975 IN DIRECTION OF "PHYSICS RESEARCH". Kartashev, K. B. Oct 1975. Translation of Russian Paper.

In selected USSR papers on plasma physics and controlled thermonuclear fusion.

A review is given of plasma research in USSR during 1974–1975. Brief statements on each research program are included. (MOW)

16763 (FRNC-TH-557) SPECTROSCOPIC STUDY OF A HIGH FREQUENCY INDUCED PLASMA. Mermet, J. M. (Lyon-1 Univ., 69 (France)). 1974. 176p. (In French). INIS.

Excitation mechanisms in emission spectrometry were studied in a simple source consisting of a high-frequency plasma torch supplied with aqueous solutions by means of ultrasonic nebulization associated with a desolvating system. The excitation temperatures of the argon and of the elements excited were found to be comparable (6000 ± 500°K), but this is not the case for the electron densities which showed a difference of a factor 100. Moreover the electron temperature of argon is about 3000K higher than its excitation temperature the conclusion being that the source was not in local thermodynamic equilibrium (LTE). Investigation of the electrical parameters showed that the electron density could be varied within a ratio of about 10. On the other hand a study of the action of sodium, usually considered as an electrophilic element on elements of higher ionization energy, showed that the temperature and electron density hardly vary when the concentration of the components in the plasma-generating medium is changed. Saha's law relative to the mixture is then no longer directly applicable, which explains the absence of LTE. (FR)

16764 (TH-73-E-35) VACUUM ARC AS A FACILITY FOR RELEVANT EXPERIMENTS IN FUSION RESEARCH. Annual Report, 1972. Bastian, C.; Boeschoten, F.; Hekman, H.; Komen, R.; Riske, H. P.; van Iersel, A. (Technische Hogeschool Eindhoven (Netherlands)). Feb 1973. 23p. INIS.

The regime of plasma parameters in the high vacuum arc at Eindhoven "John S. Luce" is such that relevant experiments for fusion research may be done, particularly in the disregarded field of plasma rotation. It is a considerable advantage of this facility that it has a simple and variable geometry and is operated in the stationary state. A description of the apparatus is given. The available diagnostic tools are laid out in such a way that the plasma rotation and the related turbulent phenomena may be measured adequately. Experiments were started in February 1973 and some of the first results are given in this report. (NL)

16765 SOME TOPICS IN PLASMA PHYSICS. pp 72-98 of Physics and the Energy Industry. Summer School in Physics. Bedford Park, South Australia; Flinders University (1974).

From summer school on physics and the energy industry; Bedford Park, Australia (Jan 1974). See CONF-740137–.

Topics which are discussed include: (1) plasma definition, (2) occurrence of plasmas, (3) thermal ionization, (4) non-equilibrium plasmas, (5) electrical conductivity, (6) mathematical models of plasma. (AT)

16766 ELECTRODYNAMIC ACCELERATOR PLASMA AND ITS USE IN RESEARCH ON CONTROLLED THERMONUCLEAR FUSION. Vasil'ev, V. I.; Gervids, V. I.; Zhitlukhin, A. M.; Lotopskii, A. P.; Lyashenko, V. N.; Skvortsov, Yu. V.; Strunnikov, V. M.; Umrikhin, N. M.; Tserevitinov, S. S. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 135-140(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The stream characteristics of a powerful electrodynamic accelerator were investigated. It was shown that under ideal conditions the efficiency can reach several tens of per cent and that the total energy of the stream is equal to 20 kJ with a directional proton velocity of ~10^7 cm/s. By comparing experimental observations with calculations a model was found which made it possible to design an accelerator for specified plasma parameters. Preliminary experiments on plasma transport and injection into magnetic fields were carried out. It was found that the motion of a plasma with $n \sim 10^{15}$ cm^{-3}, $T_\perp \sim 20$ eV and $T_\parallel \sim 1$ keV in magnetic fields of 500-2000 G with a longitudinal gradient of up to 0.55 kG/cm is accompanied by longitudinal (i.e. in the stream direction) adiabatic compression and heating of the plasma. An increase in the gradient to more than 0.55 kG/cm accordingly leads to rapid magnetization of the plasma because of the appearance of anomalous resistivity. The range of fields and gradients covered allows the optimum conditions for transport and injection of the stream into the magnetic field to be described. (auth)

16767 PROCESSES NEAR THE PLASMA-METAL BOUNDARY UNDER DISRUPTIVE CONDITIONS IN "PLASMA FOCUS" SYSTEMS. Filippov, N. V.; Bazdenkov, S. V.; Belyaeva, I. F.; Bezbatchenko, V. A.; Gureev, K. G.; Filippova, T. I. (Inst. of Applied Mathematics, Moscow). Nucl. Fusion; Suppl.: 169-174 (1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

In the present paper on "breakup" regimes a complex series of associated phenomena are analysed experimentally and theoretically, viz: interaction of plasma with metal, acceleration of the current sheath, formation of a powerful electron current, generation of hard x-rays, occurrence of high-energy deuterons, appearance of splitting at the back of the anode. Time and space properties of bremsstrahlung have been determined, integrated energy spectra for high-energy deuteron and hard x-ray components have been obtained with their dependence on discharge parameters also being ascertained. The method used for processing hard x-ray spectra enabled the primary electron current spectrum to be reconstructed. From a cycle of metallurgic investigations based on structural changes in the anode material, the pulse pressure exerted by the electron beam on the anode was estimated, bearing in mind that the total discharge current is carried by the directional electron current. On the basis of given data, a model was proposed in which formation of the electron beam and, accordingly, acceleration of electrons and deuterons takes place in the electric field occurring where the current is ruptured by a thin layer of metallic vapour above the anode surface. (auth)

16768 REPORT ON THE FIFTH INTERNATIONAL CONFERENCE ON PLASMA PHYSICS AND CONTROLLED NUCLEAR FUSION RESEARCH, NOVEMBER 1974, TOKYO. Yamamoto, K. (Japan Atomic Energy Research Inst., Tokyo). Ann. Nucl. Energy; 2: No. 7/8, 565-577(Aug 1975).

A summary is given of the papers presented at the Fifth International Conference on Plasma Physics and Controlled Nuclear Fusion Research which was organized by the International Atomic Energy Agency (IAEA). The conference was held in Tokyo, Japan, from November 11 to 15, 1974 and was attended by some 500 participants from 24 countries and 3 international organisations. About 200 papers were presented and discussed in 16 sessions during the conference. A major value of the conference lay in demonstrating the steady progress and increasing understanding of the physics of controlled nuclear fusion, rather than any limited number of highlights. (auth)

16769 THERMODYNAMICS OF A NON-IDEAL CESIUM PLASMA. Bushman, A. V.; Lomakin, B. N.; Sechenov, V. A.; Fortov, V. E.; Shchekotov, O. E.; Sharindzhanov, I. I. (Moscow Physical-Technical Inst.). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1624-1633(Nov 1975). (In Russian)

Experiments on dynamic compression of cesium vapor are carried out with heated diaphragm shock tubes. Data pertaining to the caloric equation of state H(P, V) are obtained in a broad range of the phase diagram. These data are employed for calculating the shock compression temperature and the isentropes of an imperfect plasma. The effect of strong coulomb interaction on the thermodynamic properties of a dense plasma is studied by comparing the experimental results with theoretical models. (auth)

16770 PHYSICS OF IONIZED GASES, 1974. Proceedings of the 7th Yugoslav Symposium, Rovinj, Yugoslavia, September 16–21, 1974. Vujnovic, V. (ed.). Zagreb; University of Zagreb (1974). 1041p. (CONF-740985-P2).

From 7th symposium on physics of ionized gases; Rovinj, Yugoslavia (16 Sep 1974).

Thirty-three papers are included that deal with various aspects of atomic collision processes, particle interactions with solids, and phenomena in ionized gases. (MOW)

16771 DEFORMATION OF THE CONTOURS OF HYDROGEN SPECTRAL LINES IN A PLASMA INDUCED BY A STRONG ELECTROMAGNETIC FIELD. Lisitsa, V. S. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 1, 195-205(Jul 1975). (In Russian).

Deformation of the Holtsmark absorption spectrum of hydrogen in a plasma irradiated by a strong electromagnetic (laser) beam $E_0 e^{i\omega t}$ is considered. The character of the spectrum is defined by the parameter $V_0 T_\phi(\Delta\omega)$, where V_0 is the interaction between the atom and field E_0 and T_ϕ is the time of phase coherence loss by the atom due to thermal motion of the ions ($T_\phi \sim (T/\Delta\omega)^{1/2}$, where T_T is the Chandrasekhar – von Neuman ion microfield lifetime). The Holtsmark theory is valid for $V_0 T_\phi \ll 1$. Absorption decreases by $(V_0 T_\phi)^3$ times when $V_0 T_\phi \gg 1$, the decrease being dependent on the fluctuation rate of the ion field. The effect may be exploited for determining ion temperatures or for studying the dynamics of an ion microfield in a plasma. (auth)

16772 FIELD DISTRIBUTION OF A SOURCE AND ABSORPTION OF ENERGY IN AN INHOMOGENEOUS MAGNETO-ACTIVE PLASMA. Galushko, N. P.; Erokhin, N. S.; Moiseev, S. S. (Physical-Technical Inst., Kharkov). Zh. Eksp. Teor. Fiz.; 69: No. 1, 142-154(Jul 1975). (In Russian)

Distribution of fields of oscillations induced by a source in a magnetoactive plasma and absorption of h.f. wave energy are investigated. The influence of plasma inhomogeneity, thermal motion of the particles, finite size of the source and other factors on the source field structure are considered. (auth)

16773 BREMSSTRAHLUNG FROM ELECTRON-ATOM COLLISIONS IN A MODERATELY DENSE PLASMA. Roldugin, V.I.; Yakubov, I.T. (Institute of High Temperatures, Academy of Sciences of the USSR). High Temp. 13: No. 2, 393-396 (Mar 1975).

The correction to electron-atom bremsstrahlung cross section due to scattering from two atoms in a weakly ionized plasma is calculated. (AIP)

Plasma Kinetics (Experimental)

16774 (TH-74-E-45) EXPERIMENTS WITH A LARGE SIZED HOLLOW CATHODE DISCHARGE FED WITH ARGON. Annual Report, 1973. Bastian, C.; Boeschoten, F.; Hekman, H.; Komen, R.; Riske, H. P.; van Iersel, A. (Technische Hogeschool Eindhoven (Netherlands)). Apr 1974. 39p. INIS.

Several plasma parameters which are pertinent to the rotation of the plasma column of the hollow cathode discharge "John Luce" were measured. Several improvements to the device were made, notably concerning the construction of the electrodes and their supports. The ion temperature, T_i was measured with a Fabry-Perot interferometer; depending on arc current and gas flow T_i may be varied in argon arc in the range 1-10 eV. The magnetic field strength, B, is adjustable from 600-6000 Gauss. The plasma column is fully ionized, and for higher values of T_i and B it is also fully magnetized. Simultaneous Doppler-shift measurements of the A^{II} line 4806 A reveal that the plasma column rotates non-uniformly around its axis. (Order of magnitude of angular frequency is 10^5 rad/sec.) At larger distances from the axis the rotation was measured with a pendulum and with a directional Langmuir Probe. The object of the experiments is to disclose the connection between this rotation and the stability of the plasma column. Langmuir Probes are used to measure radial density profiles under various conditions in the arc. A flat probe with its normal to the surface pointing in radial direction makes reliable ion density measurements possible, even in the presence of a magnetic field. Floating potential measurements were used in order to estimate the radial electric field strength and the drift velocity which is related to it. The electron temperature, T_e, is measured with less accuracy. (NL)

16775 EXCITATION OF ELECTROMAGNETIC WAVES IN A PLASMA LOCATED IN A HOMOGENEOUS MAGNETIC FIELD BY AN INTENSE RELATIVISTIC ELECTRON BEAM. Krementsov, V. I.; Rabinovich, M. S.; Rukhadze, A. A.; Strelkov, P. S.; Shkvarunets, A. G. (Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 4, 1218-1229(Oct 1975). (In Russian)

Radiation emission by a relativistic electron beam injected into a smooth metallic wave guide partially filled with a magnetized plasma is investigated experimentally. It is shown that in the case of large angular scatter of the injected electrons emission occurs at cyclotron frequency of the relativistic electrons, the intensity of the radiation increasing by almost two orders of magnitude compared to vacuum emission on growth of the plasma density. This result is ascribed to the effect of charge neutralization of the beam on injection into the plasma. (auth)

16776 PLASMA CLUSTER ACCELERATION BY MEANS OF EXTERNAL MAGNETIC FIELD. Maftul, J.; Maloch, J.; Stanek, Z.; Sobra, K. (Czech Technical Univ., Prague). Czech. J. Phys.; 25: No. 11, 1208-1219(1975).

The possibility to employ external magnetic field for acceleration of plasma clusters is discussed theoretically and experimentally. The optimum value of the magnetic field was found for the "show plough" model, in which case there is the maximum cluster acceleration. The obtained results show a real possibility of further increasing the plasma cluster velocity in the electromagnetic shock tube. (auth)

16777 SPECTROSCOPIC INVESTIGATION OF A MICROWAVE DISCHARGE IN HYDROGEN. Batenin, V.M.; Zrodnikov, V.S.; Roddatis, V.K.; Chinnov, V.F. (Institute of High Temperatures, Academy of Sciences of the USSR). High Temp. 13: No. 2, 250-257 (Mar 1975).

The spectral characteristics of an atmospheric-pressure hydrogen plasma in a coaxial microwave plasmatron with a specific energy supply of 1 kW/cm² are investigated in detail. In the axial region of the discharge the plasma is in a weakly nonequilibrium state (T_e = 10,000°K, T_a = 8500°K, $y_e = n_e/n_{e0} \simeq 0.4$) due to the diffusion losses. The experimental data are in good agreement with the results of B. E. Meierovich's theory for an equilibrium RF discharge. (auth)

16778 COOLING OF PLASMAS BY HEAT TRANSFER IN A METAL WALL. Bernhardi, K.; Wiesemann, K. (Marburg Univ. (F. R. Germany). Fachbereich Physik). Phys. Lett., A; 54: No. 5, 417-418(6 Oct 1975). (In German)

The electron temperature was measured in a diffusion plasma enclosed by a metallic wall. The plasma was formed from the negative glow of a hollow cathode discharge diffusing through a grid serving as anode. It is shown that the electron temperature changes from 2000 to 2200 K, if the wall potential relative to the anode grid changes from zero to −0,2V. (NL)

16779 LABORATORY OBSERVATIONS OF RF EMISSIONS AT ω_p AND $(n+1/2)\ \omega_p$ IN ELECTRON BEAM-PLASMA AND BEAM-BEAM INTERACTIONS. Bernstein, W.; Leinbach, H. (NOAA Space Environment Laboratory, Boulder, Colorado 80302); Cohen, H.; Wilson, P.S.; Davis, T.N.; Hallinan, T.; Baker, B.; Martz, J.; Zeimke, R.; Huber, W. J. Geophys. Res. 80: No. 31, 4375-4379 (1 Nov 1975).

Electric field emissions at frequencies of $(n+1/2)\ f_p$ have been generated in a large-scale electron beam experiment in the giant NASA vacuum facility in Ohio. These emissions arise when a contrastreaming beam configuration exists, the primary beam consisting of monoenergetic electrons (50 eV to 5 keV) and the other beam of lower-energy 'backscattered' secondary electrons. It is suggested that the same mechanism could also be the source of the observed $3/2 f_p$ emissions at auroral latitudes. In the absence of the beam-beam instability, weak oscillations were observed at the plasma frequency. In the latter case no significant modifications of the primary beam velocity distribution occurred, and the beam configuration is adequately described by single-particle motion in the ambient magnetic field. (auth)

Plasma Kinetics (Theoretical)

Refer also to abstracts 16743, 17900, 17941, and 18332.

16780 (ERDA-tr-66, pp 8-13) TOKAMAKS AND DIMENSIONAL ANALYSIS. Kadomtsev, B. B. (Inst. of Atomic Energy, Moscow). Oct 1975. Translation of Russian paper.

In selected USSR papers on plasma physics and controlled thermonuclear fusion.

The behavior of a completely ionized pure hydrogen plasma in a tokamak is studied. Since all the quantum phenomena in this postulation are excluded, the behavior of this plasma is determined completely by classical laws of the motion of its charged particle components and by the Maxwell equations for an electromagnetic field. The theoretical analysis is presented. (MOW)

16781 GRID EFFECTS ON THE PLASMA SIMULATION BY THE FINITE-SIZED PARTICLE. Abe, H.; Miyamoto, J.; Itatani, R. (Kyoto Univ.). J. Comput. Phys.; 19: 134-149(1975).

About the so-called usual models, in which the total momentum is conserved, it is well known that the total energy is not conserved due to the nonuniformity of space caused by spatial grids. It fluctuates and increases in time from a stochastic origin. In order to see the accuracy of the plasma simulations, it is important to evaluate the fluctuation K/sub g/, which is more dominant for small errors during the shorter time. We study its standard deviation in t, sigma[K/sub g/], and the correlation time of dK/sub g//K . dt, tau/sub c/, about periodic one-dimensional systems, where K is the kinetic energy. The stochastic theory was used to evaluate sigma[K/sub g/]. The scaling law was obtained sigma[K/sub g/]/K approximately equal to $(2/pi)^{1/2}$. eta . $[(2M)^{1/2}n/sub\ s/lambda/sub\ D/]^{-1}$. (t tau/sub c/ omega/sub p/²)$^{1/2}$, where 2M is the number of the grids per one period, n/sub s/ is the electron density, lambda/sub D/ is the Debye length, and omega/sub p/ is the plasma angular frequency. The coefficient eta depends on the magnitude of the unphysical grid force of each model. Simulations with the usual models (CIC−PIC, modified SUDS, and method 2/2) support this scaling law. It is found that tau/sub c/ approximately equal to DELTA t if DELTA t is sufficiently large, and tau/sub c/ approximately equal to $^1/_4$ DELTA/v/sub th/ if DELTA/(DELTA t . v/sub th/) greater than 3, where DELTA t is the time step, DELTA is the grid distance, and v/sub th/ is the thermal velocity of the electron. (auth)

16782 DRAG OF ELECTRONS ON ABSORPTION OF LIGHT. Amus'ya, M. Ya.; Baltenkov, A. S. (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksp. Teor. Fiz.; 69: No. 2, 547-554 (Aug 1975). (In Russian)

It is shown that the existence of a nonzero photon momentum results in ordered motion of electrons on absorption of light in a plasma. The drag current arising on absorption of laser frequency light by electrons in a weakly ionized gas is calculated. It is shown that drag during absorption by neutral atoms exceeds the Compton motion providing atomic concentration is greater than 10^{15} cm^{-3}. (auth)

16783 WEAK LANGMUIR TURBULENCY OF AN ISOTHERMAL PLASMA. Zakharov, V. E.; Musher, S. L.; Rubenchik, A. M. (Inst. of Automation and Electrometry, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 1, 155-168(Jul 1975). (In Russian).

The fine structure of weak Langmuir turbulency spectra produced by induced scattering by ions is studied. The spectrum is found to be stationary only for a small degree of turbulency $(W/nT < (kr_D/N)(M/m)_{ik}$; N is the number of particles in the Debye sphere). Otherwise the spectrum is nonstationary and consists of solitons moving in k-space and absorbed in the small wave number region by a Langmuir collapse mechanism. Depending on excitation conditions the spectrum may be regular or consist of discrete harmonics. The analytical conclusions are confirmed by numerical calculations. (auth)

16784 KINETIC DESCRIPTION OF LINEAR THETA-PINCH EQUILIBRIA. Batchelor, D. B.; Davidson, R. C. (Univ. of Maryland, College Park). J. Plasma Phys.; 14: No. 1, 77-92 (Aug 1975).

Equilibrium properties of linear theta-pinch plasmas are studied within the framework of the steady-state ($\partial/\partial t = 0$) Vlasov–Maxwell equations. The analysis is carried out for an infinitely long plasma column aligned parallel to an externally applied axial magnetic field $B_z^{ext}e_z$. Equilibrium properties are calculated for the class of rigid-rotor Vlasov equilibria, in which the th component distribution function ($H_\perp$, P_θ, ν_s) depends on perpendicular energy H and canonical angular momentum P, exclusively through the linear combination $H_\perp - \omega_j P_\theta$, where w_j = const. = angular velocity of mean rotation. General equilibrium relations that pertain to the entire class of rigid-rotor Vlasov equilibria are discussed; and specific examples of sharp- and diffuse-boundary equilibrium configurations are considered. Rigid-rotor density and magnetic field profiles are compared with experimentally observed profiles. A general prescription is given for determining the functional dependence of the equilibrium distribution function on $H_\perp - \omega_j P_\theta$ in circumstances where the density profile or magnetic field profile is specified. (auth)

16785 EXPANSION OF A PLASMA INTO A VACUUM. Crow, J. E. (Atlas Computer Lab., Chilton, Eng.); Auer, P. L.; Allen, J. E. J. Plasma Phys.; 14: No. 1, 65-76(Aug 1975).

This paper reports calculations of the collision-free expansion of a semi-infinite plasma. It is shown that the ion front is accelerated to velocities comparable with the thermal velocity of the electrons. (auth)

16786 ANOMALOUS DIFFUSION OF A LOW DENSITY PLASMA IN ADIABATIC TRAPS. Putvinskii, S. V.; Timofeev, A. V. Zh. Eksp. Teor. Fiz.; 69: No. 1, 221-233(Jul 1975). (In Russian).

It is shown that if flute oscillations are excited in a plasma an appreciable diffusion of the latter may be evoked by even rare coulomb collisions. The diffusion mechanism under consideration may resemble that of neoclassical diffusion. In both cases transfer of particles across a magnetic field takes place along determined trajectories whereas coulomb collisions simply transfer the particles from one trajectory to another. (auth)

16787 TRANSITION RADIATION IN A WEAKLY INHOMOGENEOUS AND NONSTATIONARY PLASMA. Erokhin, N. S.; Moiseev, S. S.; Nazarenko, L. A. (Physical-Technical Inst., Kharkov). Zh. Eksp. Teor. Fiz.; 69: No. 1, 131-141(Jul 1975). (In Russian).

Transition radiation of a charge is considered which is related to smooth variation of plasma density in space or time. Various types of anisotropy of transition radiation are investigated. It is demonstrated that with growth of the characteristic dimensions of either time or spatial variation of plasma density the anisotropy of angular distribution of transition radiation energy increases for frequencies exceeding optical frequencies. (auth)

16788 QUADRUPOLE MOMENT OF A LOCALIZED LANGMUIR PERTURBATION IN AN ELECTRON PLASMA. Ryutova, M. P. (Inst. of Nuclear Physics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 1, 189-194(Jul 1975). (In Russian).

It is shown that a static electric field of a quadrupole nature appears in the space surrounding a three-dimensional localized Langmuir perturbation at distances which considerably exceed

the dimension of the perturbation. The quadrupole moment corresponding to this "long-range" field is found. (auth)

16789 DERIVATION AND PROPERTIES OF A BALESCUE–LENARD LIKE EQUATION. Pelletier, G.; Pomot, C. (Univ., Grenoble, France). J. Plasma Phys.; 14: No. 1, 153-167(Aug 1975).

This paper derives a kinetic equation and discusses its validity for a stationary turbulent plasma. For this purpose, the Dupress–Weinstock model in the weak-coupling approximation is used, and takes into account ballistic streams. Frictional effects appear in addition to the velocity diffusion. The diffusion causes a resonance broadening, the friction causes a frequency shift. The model is a generalization of the dressed test particle model, and leads to a kinetic equation formally similar to Balescu–Lenard's. A comparison between the model and the Dupree (Dupree, T., 1972, Phys. Fluids, 15, 334) "clump" theory is developed. Physical quantities are conserved, the H theorem is satisfied; but the asymptotic solution is not necessarily a Maxwellian distribution function. (auth)

16790 PLASMA SIMULATION USING PARTICLE CODES. Kruer, W. L. (Univ. of California, Livermore). Nucl. Technol.; 27: No. 2, 216-223(Oct 1975).

Particle codes are a powerful tool for the numerical simulation of nonlinear plasma behavior. In these codes, one follows the motion of a large number of electrons and ions in their self-consistent (plus externally imposed) electric and magnetic fields. The fields are solved for on a spatial grid chosen to resolve the collective behavior of the plasma (i.e., the plasma waves). The interpolation between the grid and the particle positions corresponds physically to a multipole expansion of finite-size charges about their nearest grid point location. Results from particle codes agree with numerical solutions of the Vlasov equation. In laser fusion applications, particle codes are used to study the absorption of laser light. (auth)

16791 THREE-DIMENSIONAL MAGNETOHYDRODYNAMIC EQUILIBRIA OF TOROIDAL STELLARATORS. Shohet, J.L.; Anderson, D.T. (University of Wisconsin, Madison, Wisconsin 53706); Betancourt, O.L.; Tataronis, J.A. Phys. Rev. Lett. 35: No. 21, 1433-1436 (24 Nov 1975).

Fully nonaxisymmetric magnetohydrodynamic equilibria have been calculated numerically for the Proto-Cleo stellarator utilizing a fully three-dimensional magnetohydrodynamic equilibrium code. It was found that recently observed anomalous circulating currents in stellarators may be a result of the equilibrium condition. (auth)

16792 RIGID-ROTOR EQUILIBRIA OF NONNEUTRAL PLASMAS. Theiss, A.J.; Mahaffey, R.A.; Trivelpiece, A.W. (University of Maryland, Department of Physics and Astronomy, College Park, Maryland 20742). Phys. Rev. Lett. 35: No. 21, 1436-1438 (24 Nov 1975).

A cold, constant-density, cylindrical, nonneutral plasma column confined by a uniform axial magnetic field has equilibria characterized by rigid-rotation frequencies given by $\dot{\theta} = 1/2\omega_c[1 \pm (1-2\omega_p{}^2/\omega_c{}^2)^{1/2}]$. Measurements of these fast (+) and slow (−) equilibria are compared with a cold-fluid-theory model of nonneutral plasmas. (auth)

16793 RIGID ROTATION AND SURFACE ENVELOPES OF NONNEUTRAL-PLASMA COLUMNS. Mahaffey, R.A.; Goldstein, S.A.; Davidson, R.C.; Trivelpiece, A.W. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). Phys. Rev. Lett. 35: No. 21, 1439-1441 (24 Nov 1975).

The bulk rotation velocity and surface envelope of a drifting unneutralized electron beam have been measured. These measurements verify various properties predicted by nonneutral-plasma theory. One unusual feature is that in some instances, the bulk rotation is opposite to that normally associated with the equilibria. Rotation at angular velocities greater than ω_c is also observed. In addition, the wavelength of the time-independent surface envelope is found to depend on the amount of ripple present. (auth)

16794 ENERGY DISTRIBUTION OF ELECTRONS AND THE IONIZATION EQUILIBRIUM EQUATION IN A PARTIALLY IONIZED PLASMA. Vorob'ev, V.S. (High-Temperature Institute, Academy of Sciences of the USSR). High Temp. 13: No. 2, 229-233 (Mar 1975).

The explicit form of the electron distribution function is found in the range of positive and negative energies. It is shown that at low energies it has an integrable singularity which does not affect the total number of charges but is manifested in formulating the ionization-equilibrium equation. (auth)

16795 INVERSION OF ABEL'S INTEGRAL EQUATION BY A DIRECT METHOD. Fan, L. S.; Squire, W. (West Virginia Univ., Morgantown (USA)). Comput. Phys. Commun.; 10: No. 2, 98-103(Aug 1975).

The problem is to determine the radial distribution of the emission coefficient from the measured intensity distribution when the source is thin and axially symmetrical. Abel's integral equation is inverted by a direct procedure using product integration. A procedure using splines is used for interpolating the data, which need not be equally spaced, to the needed points and to interpolate the solution to the desired output points. The integration is stopped a few steps short of the center because of the singularity, and the solution is extrapolated by the spline procedure. The dimensioning of internal arrays limits the number of data points and the number of steps in the integration to 300 points; also, no provision is made for smoothing data. Typical running time is 6 seconds for five sets of data (31 points each) and 60 steps in integration. (NL)

Plasma Production

Refer also to abstract 17158.

16796 DIRECTIVITY OF SCATTERED LIGHT AND X-RAYS IN A LASER PLASMA. Krokhin, O. N.; Mikhailov, Yu. A.; Pustovalov, V. V.; Rupasov, A. A.; Silin, V. P.; Slizkov, G. V.; Shikanov, A. S. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 1, 206-220(Jul 1975). (In Russian).

The directivity of scattered light and X-ray quanta from a dense plasma produced by focusing a linearly polarized laser beam ($\lambda = 1.06\ \mu$) on the surface of a solid target is investigated for a flux $q \leq 2 \times 10^{14}$ W/cm^2 and pulse duration $\tau \approx 3$ nsec. It is found that for such fluxes the light unabsorbed by the plasma (which is of the order of several percent) is reflected by the plasma specularly for both normal or oblique incidence of the laser beam on the surface of an aluminium or polyethylene target. A considerable fraction of normally incident light is not re-emitted (reflected) into the solid angle of the focusing system. An investigation of the time course of second harmonic emission ($\lambda = 0.53\ \mu$) shows that in contrast to reflected fundamental frequency light the intensity of the second harmonic does not oscillate in time. In the 2 to 4 keV energy range an anisotropy is observed in the number of X-ray quanta (of the order of 200 to 300%) in directions perpendicular or parallel to the polarization vector of the laser beam. The experimental results are discussed and interpreted on basis of the theory of parametric action of intense radiation beams on a plasma. (auth)

16797 DEPENDENCE OF AIR BREAKDOWN THRESHOLD FOR A FOCUSED LASER BEAM ON GEOMETRY OF THE FOCAL REGION. Volkov, V. A.; Grigortev, F. V.; Kalinovskii, V. V.; Kormer, S. B.; Lavrov, L. M.; Maslov, Yu. V.; Urlin, V. D.; Chudinov, V. P. Zh. Eksp. Teor. Fiz.; 69: No. 1, 115-121(Jul 1975). (In Russian).

The effect of the parameters of a laser beam and focusing system on the breakdown threshold of laboratory air excited by laser radiation with a wavelength of 1.06μ is investigated. In the focal volume range investigated the electron diffusion losses are negligible over the duration of the pulse. It is proven experimentally that in this case the breakdown threshold is determined by the length of the caustic and is independent of magnitude of the focal volume. Decrease of breakdown threshold of air with increase of caustic length is explained by self-focusing of the laser radiation in air which is weakly ionized as a result of action of the laser radiation on aerosols which are always present in laboratory air. (auth)

16798 EXPLOSION GENERATOR OF NON-IDEAL PLASMA. Fortov, V. E.; Ivanov, Yu. V.; Dremin, A. N.; Gryaznov, V. K.; Bespalov, V. E. (Inst. of Chemical Physics, Moscow). Dokl. Akad. Nauk SSSR; 221: No. 6, 1307-1309(21 Apr 1975). (In Russian).

A dynamic method is proposed for obtaining a strongly nonideal plasma. It is based on the constriction and irreversible heating of gases in the front of a strong ionizing shock wave. Characteristic parameters of Ar and Xe plasmas under these conditions are tabulated. (JSR)

16799 COMPUTATION OF THE COMPOSITIONS OF PLASMAS WHICH DEVELOP IN CLOSED SYSTEMS. Bokova, N.A.; Ivasenko, N.F. (V. D. Kuznetsov Siberian Physicotechnical Institute). High Temp. 13: No. 2, 225-228 (Mar 1975).

The compositions of plasmas which develop in closed volumes (V=const) are calculated for the filler gases Xe, N_2, O_2, CO_2, H_2 under the condition that the temperature in the volume must be constant and interactions between the plasma and the envelope walls are absent. The compositions of plasmas are also calculated on the assumption that p (T) =const. It is shown that the plasma characteristics for the same initial parameters depend very strongly on the condition governing the development of the plasma. (auth)

16800 EXPERIMENTAL INVESTIGATION OF THE INTERACTION BETWEEN LASER RADIATION AND A TARGET IN AIR. Kozlova, N.N.; Markovich, I.E.; Nemchinov, I.V.; Petrukhin, A.I.; Pleshanov, Yu.E.; Rybakov, V.A.; Sulyaev, V.A. (O.Yu. Shmidt Institute of Terrestrial Physics, Academy of Sciences of the USSR). Sov. J. Quantum Electron. 5: No. 9, 1048-1054 (Sept 1975).

An investigation was made of the interaction of laser pulses of 1 μsec duration and up to 30 J energy with a target in air on which the laser radiation focused in a spot of 5–8 mm diameter. The shape of a plasma jet formed on the target, velocity of the plasma front and shock wave, brightness temperature, and pressure were determined at different moments. The experiments were carried out in the power density range from 10 to 300 MW/cm^2 and the illumination in the focal spot was almost uniform. The results obtained indicated that up to about 100 MW/cm^2 an absorption wave formed in the leading edge of an opaque (for the incident radiation) jet and this wave was preceded by a transparent shock wave. The expanding plasma jet acted as a piston on the surrounding cold layers ("expulsion regime"). At higher power densities a detonation regime was observed and it was complicated by radiative energy transfer at wavelengths corresponding to the continuous spectrum of the hot plasma. During the initial part of a radiation pulse the flow conditions were nearly planar but as the jet rose above the target to distances of the order of illuminated spot size, the motion became two-dimensional. (auth)

Plasma Stability

Refer also to abstract 16748.

16801 (CEA-CONF-3110) DRIFT INSTABILITIES IN HOT PLASMAS. Gravier, R. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). 1974. 35p. (In French). INIS.

From summer school. Instability and turbulence in hot plasmas; Cadarache, France (1 Jul 1974).

The drift waves related to the magnetic plasma confinement are observed in confinement devices. A number of mechanisms are theoretically shown to be able to render them instable. ODE experiments devoted to the study of their behavior in connection with a specific stabilizing mechanism (collisional wave, resonant wave and partly trapped electron wave) show a strong agreement between observations and theoretical predictions in the laminar range. (FR)

16802 (ERDA-tr-97) INSTABILITY OF BREAKAWAY IN TOKAMAKS. Kadomtsev, V. V. Translated from Fiz. Plazmy; 1: No. 5, 710-715(1975). 11p. Dep. NTIS $3.50.

The onset of the disruptive instability in tokamaks is discussed. A brief theory is presented for this instability. (MOW)

16803 (ERDA-tr-98) DYNAMIC STABILIZATION OF HELICAL MODES OF THE PLASMA COLUMN BY HIGH FREQUENCY FIELDS AND A SYSTEM OF AUTOMATIC CONTROL. Demirkhanov, R. A.; Kirov, A. G.; Sidorovo, V. P.; Samoilenko, Yu. I.; Gubarev, V. F.; Krivonos, Yu. G. Translated from Fiz. Plazmy; 1: No. 5, 716-721(1975). 11p. Dep. NTIS $3.50.

Stability relative to perturbation of helical modes of a magnetized plasma column with a cross-sectionally homogeneous longitudinal current in the presence of a stabilizing high frequency field and an automatic regulating system is studied. The automatic regulating system may accept and amplify each space-time harmonic individually. The disperse equation and its analysis are described. (MOW)

16804 (MATT-1156) DESTABILIZATION OF THE TRAPPED ELECTRON MODE BY MAGNETIC CURVATURE DRIFT RESONANCES. Adam, J. C.; Tang, W. M.; Rutherford, P. H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Dec 1975. Contract E(11-1)-3073. 24p. Dep. NTIS $4.00.

Electron curvature drift resonances, ignored in earlier work on the trapped-electron modes, are found to exert a strong destabilizing influence in the lower collision frequency range of these instabilities. Effects arising from ion temperature gradients, shear, and finite ion gyroradius are included with these vector nebla-drifts in the analysis, and the resultant eigenvalue equation is solved by numerical procedures rather than the commonly used perturbation techniques. For typical tokamak parameters the maximum growth rates are found to be increased over earlier estimates by roughly a factor of 4, and requirements on magnetic shear strength for stabilization are likewise more severe and very difficult to satisfy. For inverted density profiles, this new destabilizing effect is rendered ineffective, with the result that the modes can be stabilized for achievable values of shear provided the temperature gradients are not too severe. Estimates of the particle and thermal energy transport are given for both normal and inverted profiles. (auth)

16805 EXPERIMENTAL STUDY OF PARAMETRIC INSTABILITIES AND ANOMALOUS HEATING IN PLASMA. Batanov, G. M.; Rabinovich, M. S. (Lebedev Inst. of Physics, Moscow). Nucl. Fusion; Suppl.: 127-134(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Over the last few years the study of the dissipation of electromagnetic wave energy in a hot plasma has become perhaps one of the main problems of high-temperature plasma physics and controlled thermonuclear fusion. The focus of attention is on the processes by which electromagnetic energy is transformed into potential plasma waves and the processes involving relaxation of the latter. In this paper the authors summarize the experimental research into these processes conducted at the Lebedev Physics Institute over the 10 cm wave band. In the case of an isotropic plasma the authors recorded nonlinear generation of Langmuir noise, the energy density of which was found to be comparable, in order of magnitude, with that of a pump wave. They detected the generation of fast-electron streams, the nonstationary character of the latter with respect to time, and nonlinear transmissivity of the plasma layer. In the case of a magnetoactive plasma they studied the parametric excitation of oscillations at the upper hybrid frequency during its resonance with the first overtone of the pump wave. Excitation of plasma noise was found to be accompanied by a flux of fast-electrons, in the energy spectrum of which separate groups were detected. It was also found that the effective collision frequency increased by 1-3 orders, compared to the pair-collision frequency. In the region of magnetic waves close to the electron cyclotron resonance the authors observed forced Mandel'shtam-Brillouin scattering and kinetic instability of the plasma. It was found that the excitation of ionic Langmuir noise preceded "anomalous absorption" of waves and "anomalous heating" of electrons. The authors further consider the possibility of an experimental study of anomalous heating in plasma in the region of the lower hybrid frequencies, using the Institute's L-2 stellarator. (auth)

16806 EXPLOSIVE INSTABILITY IN INHOMOGENEOUS MEDIA. Filonenko, N. N.; Mel'nik, L. P. (Inst. of Physics, Krasnoyarsk, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 4, 1183-1194(Oct 1975). (In Russian)

Resonant nonlinear wave interactions involving negative energy waves in nonequilibrium inhomogeneous media are investigated. Inhomogeneity of the medium results in violation of phase synchronism of the waves and may be a factor which stabilizes explosive instability. Criteria for stabilization of explosive instability are obtained for various inhomogeneities, including small-scale inhomogeneity. An oscillatory solution is obtained for a strongly inhomogeneous medium. A special study is made of regions in the vicinity of points at which phase synchronism holds exactly. An appreciable increase of wave intensity or either efficient instability stabilization occurs depending on the phase relations in these regions. It is demonstrated that for certain phase relations explosive instability may also develop in a strongly inhomogeneous medium. Development of explosive instability in this case is step-like and the development length of the ≪ explosion ≫ increases due to instability. Examples of nonlinear interaction of waves in a nonequilibrium inhomogeneous plasma are considered. (auth)

16807 EFFECT OF LINEAR TRANSFORMATION ON ABSOLUTE PARAMETRIC INSTABILITY IN AN INHOMOGENEOUS PLASMA. Davydova, T. A.; Shamrai, K. P. (Inst. of Nuclear Research, Kiev). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1607-1616 (Nov 1975). (In Russian)

The development of absolute parametric instability in an inhomogeneous plasma is investigated in the vicinity of plasma resonance on the basis of a fourth order equation. It is shown that along with violet Langmuir satellites it should also be possible to excite red satellites as a result of the plasma becoming more transparent in the strong pumping field. The effect of linear transformation of the pumping electromagnetic wave on development of absolute instability is investigated in the geometric optics approximation. It is shown that the presence of a transformed wave considerably enlarges the instability region without appreciably altering the logarithmic increment. (auth)

16808 NONLINEAR INTERACTION OF A PARALLEL-FLOW RELATIVISTIC ELECTRON BEAM WITH A PLASMA. Jungwirth, K.; Koerbel, S.; Simon, P.; Vrba, P. (Inst. of Plasma Physics, Prague). Czech. J. Phys.; 25: No. 12, 1331-1354(1975).

Nonlinear evolution of single-mode hf instabilities ($\omega \approx k_{\parallel} v_b$) excited by a parallel-flow high-current relativistic electron beam in a magnetized plasma is investigated. Fairly general dimensionless equations are derived. They describe both the temporal and the spatial evolution of amplitude and phase of the fundamental wave. Numerically, the special case of ex-

citation of the linearly most unstable mode is solved in detail assuming that the wave energy dissipation is negligible. Then the strength of interaction and the relativistic properties of the beam are fully respected by a single parameter λ. The value of λ ensuring the optimum efficiency of the wave excitation as well as the efficiency of the self-acceleration of some beam electrons at higher values of $\lambda > 1$ are determined in the case of a fully compensated relativistic beam. Finally, the effect of the return current dissipation is also included (phenomenologically) into the theoretical model, its role for the beam-plasma interaction being checked numerically. (auth)

16809 CRITERIA FOR THREE-WAVE INSTABILITIES IN A COLD COLLISIONLESS PLASMA. Hruska, A. (National Research Council of Canada, Ottawa). J. Plasma Phys.; 14: No. 1, 93-104(Aug 1975).

A new systematic method of analysis of three-wave interactions is proposed, and applied to a description of interactions of waves (0, 1 and 2) in a homogeneous electron plasma, in which Landau damping is insignificant. Transverse, linearly polarized wave 0, which may represent an external ("pump") wave, is assumed to be in resonance with longitudinal and transverse waves 1 and 2 already existing in a weakly-turbulent plasma. The rate $(dW/dt)_j$, at which energy is transferred from wave j to the others, is calculated, assuming that directions of propagation of resonating waves are restricted by conditions of three-wave resonance only. Conditions of the form $(dW/dt)_j = 0$ constitute threshold criteria for amplification of wave j to occur. There is a brief discussion of processes during which the energy of one of the resonating waves remains constant, although energy is transferred between the other two waves. The relation between energy absorbed by the plasma and energy transferred between waves is evaluated. (auth)

16810 NONLINEAR RESONANT INSTABILITY OF A PLASMA IN THE FIELD OF AN ORDINARY ELECTROMAGNETIC WAVE. Vas'kov, V. V.; Gurevich, A. V. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 1, 176-188(Jul 1975). (In Russian).

Energy absorption of an ordinary wave due to its linear transformation by small inhomogeneities with a concentration δN is determined in the plasma resonance region. It is demonstrated that if the initial threshold value δN_{th} is exceeded the concentration perturbations δN are unstable and sharply grow. This instability leads to destruction of the smooth plasma layer in the vicinity of resonance. The threshold values of δN_{th} decrease with growth of wave power and with decrease of concentration gradient. (auth)

16811 ELECTROMAGNETIC INTERCHANGE MODE IN A PARTLY-IONIZED COLLISIONAL PLASMA. Hudson, M. K.; Kennel, C. F. (Univ. of California, Los Angeles). J. Plasma Phys.; 14: No. 1, 121-134(Aug 1975).

A collisional electromagnetic dispersion relation is derived from two-fluid theory for the interchange mode coupled to the Alfven, acoustic, drift and entropy modes in a partly-ionized plasma. The fundamental electromagnetic nature of the interchange mode is noted: coupling to the intermediate Alfven mode is strongly stabilizing for finite k_r. Both ion-viscous and ion-neutral stabilization are included; and it is found that collisions destroy the FLR cutoff at short perpendicular wavelengths. (auth)

16812 PARAMETRIC BACKSCATTERING AND ABSORPTIVE INSTABILITIES IN HOMOGENEOUS PLASMAS. Bornatici, M. (Univ., Calabria, Cosenza, Italy). J. Plasma Phys.; 14: No. 1, 105-120(Aug 1975).

The paper considers the two scattering instabilities photon decays into photon plus plasmon ($t \rightarrow t' + 1$) and photon decays into photon plus phonon ($t \rightarrow t' + s$) and the two absorptive instabilities photon decays into plasmon plus plasmon ($t \rightarrow 1 + s$). The corresponding growth rates and thresholds are determined for a homogeneous, unmagnetized plasma. The regimes of weak and moderately strong pump fields are examined, together with the possibility of purely-growing instabilities for the decays $t \rightarrow t' + s$ and $t \rightarrow 1 + s$. (auth)

16813 DISSIPATIVE TRAPPED ELECTRON INSTABILITY IN A LINEAR MACHINE. Prager, S. C.; Marshall, T. C.; Sen, A. K. (Columbia Univ., New York). Plasma Phys.; 17: No. 10, 785-797 (Oct 1975).

A study of the dissipative trapped electron instability is greatly simplified, both experimentally and theoretically, when posed in a cylindrical geometry. A derivation of the linear dispersion relation for a finite cylindrical system with two localized magnetic mirrors shows that a linear machine can support the instability with strong localization between the mirrors. The growth rate can be larger than 10% of the wave frequency which is approximately the drift frequency. A simple physical explanation is provided for the dynamics of the instability. An experiment was performed in a Q-machine converted to an ODE-type device in which the dissipative trapped electron instability was definitively identified through the dependence of the wave amplitude on mirror ratio, axial position, temperature gradient, electron collision frequency, and radial position. The wave, with the azimuthal mode number 1, is nearly monochromatic at ~50 kHz which is in the neighborhood of the drift frequency. The density fluctuation in the wave can be as high as 30%. (auth)

16814 STABILITY OF THE POSITIVE COLUMN IN A LONGITUDINAL MAGNETIC FIELD. Moser, F. (Stuttgart Univ.). Plasma Phys.; 17: No. 10, 799-819(Oct 1975).

This paper presents a contribution to the theoretical and numerical treatment of the stability of a positive column in a diffusion dominated low pressure discharge with longitudinal homogeneous magnetic field. Proceeding from the basic equations of three fluid theory, the dispersion equation for the propagation of cylindrical electrostatic waves with azimuthal mode $m = 1$ are derived. In order to discuss explicit examples, analytical expressions for growth rate and frequency as functions of wave number k have been derived in a first approximation. Regimes of stable and unstable behavior of the positive column are plotted in the k-B plane. With the aid of such stability diagrams, the influence of the finite length of the positive column on its stability can be investigated. In the mathematical solution of the boundary value problem, the amplitude functions of density and potential are developed for the complete orthogonal system of first order Bessel functions of the first kind. In the general case, the dispersion relation $D(w,k) = 0$ results in a doubly infinite determinant equal to zero. This determinant is solved numerically up to tenth order. In each case the critical plasma parameters are determined from Briggs' instability criterion, whence the quality of the first order approximation can be deduced. (auth)

16815 NONLINEAR THEORY OF INSTABILITY OF A DIFFUSIVE NEUTRAL SHEET. Galeev, A. A.; Zelny, L. M. (Inst. of Cosmic Research, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 3, 882-894(Sep 1975). (In Russian).

Nonlinear theory of kinetic instability of a collisionless plasma located in a self-consistent magnetic field with a neutral sheet is considered. The case of a diffuse neutral sheet is studied. The linear theory is developed for an arbitrary angle of propagation of growing waves. Quasilinear effects of plasma distribution relaxation involving the development of instability are considered. A nonlinear mechanism leading to instability saturation is studied qualitatively. On basis of the results obtained it is possible to evaluate the dissipation of magnetic field energy in the neutral sheet model proposed. (auth)

16816 CONVECTIVE AND ABSOLUTE INSTABILITY OF THE POSITIVE COLUMN WITH LONGITUDINAL MAGNETIC FIELD. Moser, F. (Stuttgart Univ.). Plasma Phys.; 17: No. 10, 821-840(Oct 1975).

In order to determine the character of an instability different criteria can be applied. This paper presents an application of the frequency-loop criterion of Fainberg, Kurilko and Shapiro (Fainberg, Y. B.; Kurilko, V. J.; and Shapiro, V. D. (1961) Sov. Phys. Tech. Phys. 6, 459) the pole-pinching criterion of Bers and Briggs (Bers, A. and Briggs, R. J. (1964) Bull. Am. Phys. Soc. 9, 304) and the frequency-cusp criterion of Derfler (Derfler, H. (1970) Phys. Rev. A. 1, 1467) to determine the type of the helical instability of the positive column in a diffusion dominated low pressure discharge and its dependence on the applied axial magnetic field strength. The conformal mapping of the wave number plane into the frequency plane, which is given by the dispersion relation $D(w,k) = 0$, is studied numerically especially in the area of saddle points in the k plane and in branch points of the w plane. For the numerical calculations the plasma parameters of a helium discharge and of a neon discharge are used. The results of the different criteria are compared. (auth)

16817 WATER-BAG STABILITY THEORY FOR PLANAR BOUNDED PLASMAS WITH COUNTER-STREAMING INJECTION. Hu, K. M.; Klevans, E. H. (Pennsylvania State Univ., University Park). J. Plasma Phys.; 14: No. 1, 143-152(Aug 1975).

The stability of a bounded, homogeneous, neutralized plasma with counter-streaming electron beams is analyzed. A water-bag model is used to describe the electron distribution in velocity space, so that finite beam temperature and a background plasma are included in the theory. For boundary conditions, the absorber-source wall (the diode boundary) and the reflecting wall are considered. For the former, growth-rate calculations indicate that the instability is a combination of charge bunching (counter-streaming) and diode circuit effect. As the diode length increases, the growth rate of all modes in the system approaches the maximum growth rate. For the reflecting wall, as the length increases, the maximum growth rate transfers to higher and higher order modes with shorter wavelength, while the growth rate of the lower-order modes goes to zero. (auth)

16818 COLLISIONAL DRIFT MODE IN A PARTLY-IONIZED PLASMA. Hudson, M. K.; Kennel, C. F. (Univ. of California, Los Angeles). J. Plasma Phys.; 14: No. 1, 135-142(Aug 1975).

The structure of the drift instability is examined in several density regimes. Let λ_e be the total electron mean free path, k_z the wave-vector component along the magnetic field, and $\nu_\perp/\nu_{||}$ the ratio of perpendicular ion diffusion to parallel electron streaming rates. At low densities ($k_z\lambda_e > 1$), the drift mode is isothermal, and should be treated kinetically. In the finite heat conduction regime ($(m/M)^{\frac{1}{2}} < k_z\lambda_e < 1$, the drift instability threshold is reduced at low densities ($\nu_\perp/\nu_{||} < 0.1$) and increased at high densities ($\nu_\perp/\nu_{||} > 0.1$), as compared with the isothermal threshold. Finally, in the energy transfer limit ($k_e\lambda_e < (m/M)^{\frac{1}{2}}$), the drift instability behaves adiabatically in a fully-ionized plasma, and isothermally in a partly-ionized plasma, for an ion-neutral to Coulomb collision frequency ratio $\nu_{in}/\nu_{ii} > 2(m/M)^{\frac{1}{2}}$ at $T_i = T_e = T_n$. (auth)

16819 INTERNAL KINK MODES IN TOROIDAL PLASMAS WITH CIRCULAR CROSS SECTIONS. Bussac, M.N.; Pellat, R. (Centre de Physique Théorique, Ecole Polytechnique, 91120 Palaiseau, France); Edery, D.; Soule, J.L. Phys. Rev. Lett. 35: No. 24, 1638-1641 (15 Dec 1975).

The stability criterion of the internal kink mode is given in toroidal geometry for plasmas with circular cross sections. Contrary to known results in cylindrical geometry, the internal kink mode can be stable if the pressure gradient is sufficiently low. (auth)

16820 TWO-DIMENSIONAL STABILITY OF ION-ACOUSTIC SOLITONS. Spatschek, K. H.; Shukla, P. K.; Yu, M. Y. (Ruhr-Universitaet, Institut fuer Theoretische Physik, Germany). Phys. Lett., A; 54: No. 5, 419-420(6 Oct 1975).

It is shown that one-dimensional ion-acoustic solitons in a low-β plasma are unstable with respect to perturbations perpendicular to their motion. (NL)

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Refer also to abstract 16983.

16821 (BNL-20759) STEADY-STATE PLASMA AND REACTOR PARAMETERS FOR ELLIPTICAL CROSS SECTION TOKAMAKS WITH VERY LARGE POWER RATINGS. Usher, J. L.; Powell, J. R. (Brookhaven National Lab., Upton, N. Y. (USA)). Jun 1975. 91p. Dep. NTIS $5.00.

In previous studies only circular cross section reactor plasmas were considered. The purpose of this research is to examine the effects of elliptical plasma cross sections. Several technological benefits have been determined. Maximum magnetic field strength requirements are 30 to 65 percent less than for 5000 MW (th) reactors and may be as much as 40 percent less than for circular cross section reactors of comparable size. Very large n tau values are found (10^{15} to 10^{17} sec/cm^3), which produce large burn-up fractions (15 to 60 percent). There is relatively little problem with impurity build-up. Long confinement times (60 to 500 seconds) are found. Finally, the elliptical cross section reactors exhibit a major toroidal radius reduction of as large as 30 percent over circular reactors operating at comparable power levels. (auth)

16822 (BNWL-1939-1) PACIFIC NORTHWEST LABORATORY REPORT ON CONTROLLED THERMONUCLEAR REACTOR TECHNOLOGY, JANUARY 1975-SEPTEMBER 1975. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Oct 1975. Contract E(45-1)-1830. 91p. Dep. NTIS $5.45.

The PNL staff has been studying fusion technology in areas such as economics, fusion-fission hybrid concepts, materials, neutronics, environment and safety. These studies have been scoped to make efficient use of ERDA resources, and to complement and support efforts at other laboratories. The effect the plasma and associated radiation and emission will have upon the surfaces of the first wall are being studied. Neutron sputtering experiments were made on niobium and gold and the results were evaluated for absolute neutron yields. Molybdenum and vanadium were studied for effects of ion bombardment under various conditions of helium injection. Graphite cloth is being irradiated for examination of radiation effects because it is suggested for use in several CTR concepts as a shield between the plasma and the first wall. Helium effects are being studied to characterize degradation of structural metal properties. Work is progressing on absolute measurement of the electrical resistivity of insulators and the demonstration of the feasibility of producing insulating coatings by sputter deposition. (auth)

16823 (ERDA-tr-66, pp 19-34) DEVELOPMENTS RELATED TO CONSTRUCTION OF TOKAMAK-BASED THERMONUCLEAR REACTORS. Golovin, I. N. (Inst. of Atomic Energy, Moscow). Oct 1975. Translation of Russian Paper.

In selected USSR papers on plasma physics and controlled thermonuclear fusion.

A design and some numerical calculations for a hybrid reactor containing uranium in the blanket are discussed with respect to its future use as an operating power plant. Some materials studies and technological developments are described. (MOW)

16824 (ERDA-tr-66, pp 35-38) LASER INSTALLATIONS FOR HEATING DENSE PLASMAS. Oct 1975. Translation of Russian Paper.

In selected USSR papers on plasma physics and controlled thermonuclear fusion.

A listing is given of research facilities for laser fusion studies. A brief discussion of each facility and some of the more important results obtained at each facility are presented. (MOW)

16825 (ERDA-tr-66, pp 39-42) COMMENTS ON DESIGN OF "PERF" INSTALLATION. Kolbasov, B. N.; Panov, D. A.; Pleshivtsev, N. V.; Popkov, G. N.; Semashko, N. N.; Shatalov, G. E. Oct 1975. Translation of Russian Paper.

In selected USSR papers on plasma physics and controlled thermonuclear fusion.

The development of the PERF neutron generator is discussed. The source properties and its use for investigating thermonuclear reactor materials are briefly described. (MOW)

16826 (ERDA-tr-66, pp 54-59) REVIEW OF RESEARCH ON PULSED THERMONUCLEAR SYSTEMS IN USSR IN 1974-1975. Rudakov, L. I. Oct 1975. Translation of Russian Paper.

In selected USSR papers on plasma physics and controlled thermonuclear fusion.

The discussion covers research on the search for optimum variants of using metal liners, accelerated by magnetic pressure to compress a plasma insulated from the walls of the liner being compressed by using a magnetic field. The application of powerful lasers and relativistic electron beams to compress a DT mixture and to initiate a pulsed thermonuclear reaction is reviewed. (MOW)

16827 (IFA-FR-135-1975) USE OF CODE DTF-4 FOR DETERMINING THE COEFFICIENT OF BACK-REFLECTION OF THE NEUTRON WITHIN THE THERMONUCLEAR PLASMA. OF A THERMONUCLEAR REACTOR CONTROLLED BY THE RATE OF FISSION REACTIONS. Part II. Cristea, G. (Institutul de Fizica Atomica, Bucharest (Romania)). Jun 1975. 21p. Dep. NTIS (US Sales Only) $3.50.

The neutron problems are discussed for the thermonuclear reactor controlled by the rate of the fission reactions. The results obtained by rolling the DTF-4 program in a spherical geometry in the case of an "external source" problem permit one to draw conclusions concerning the problems of the neutronics system. A relation is deduced for estimating the coefficient of back-reflection of the neutrons within the thermonuclear plasma and the focusing system is discussed. (auth)

16828 (IFA-FR-140-1975) APPLICATION OF COMPUTATION PROGRAM DSTD TO DETERMINING A SUITABLE FORM OF THERMONUCLEAR PLASMA FOR THE THERMONUCLEAR REACTOR CONTROLLED BY FISSION REACTION RATE. Cristea, G. (Institutul de Fizica Atomica, Bucharest (Romania)). 1975. 26p. Dep. NTIS (US Sales Only) $4.00.

By using a previously published computer code, this work tries to deduce an adequate spatial form of thermonuclear plasma. Since the computation program is made of a simplified model of the thermonuclear plasma, there is no possibility of deducing any such best forms by means of this program. In this program, the highest values supplied by the neutron system were used for the proportionality coefficient between the fission production and the fusion production. It is emphasized that this power thermonuclear reactor is in fact a fusion reactor, where the fission power, smaller by three orders of magnitude that the fusion power is only used for controlling the thermonuclear reactor. (auth)

16829 (IRS-T-27, pp 5-18) THE FUSION REACTOR-A CHANCE TO SOLVE THE ENERGY PROBLEM. Wienecke, R. Apr 1975. (In German)

From IRS expert discussion meeting: Protection of nuclear power plants from external impacts; Koeln, F. R. Germany (30 Oct 1974).

11 figs.; 2 tabs.

In protection of nuclear power stations against external influences-airplane crashes, shock waves, earthquakes. Conference report. (Institut fuer Reaktorsicherheit der Technischen Ueberwachungs-Vereine e.V., Koeln (F. R. Germany)).

The work deals with the physical fundamentals of nuclear fusion and the properties of the necessary plasma and gives a survey on the arrangements used today for magnetic confinement such as tokamak, stellarator, high-β experiments and laser fusion. Finally, the technology of the fusion reactor and its potential advantages are explained. (DE)

16830 (MATT-1168) MAGNETIC BRAIDING DUE TO WEAK ASYMMETRY. Rechester, A. B.; Stix, T. H. (Princeton Univ., N. J. (USA). Plasma Physics Lab.). Jan 1976. Contract E(11-1)-3073. 16p. Dep. NTIS $3.50.

Magnetic surfaces for a plasma with a helical current perturbation approximately epsilon^2 are destroyed by toroidal effects or by a second current perturbation, of incommensurate helicity, and the behavior of magnetic field lines becomes stochastic in layers of relative width epsilon^{-}/sup 1/exp (-pi/2 epsilon). (auth)

16831 (ORNL-5046, pp 96-99) HEALTH PHYSICS ASPECTS OF FUSION POWER. Easterly, C. E.; Shoup, R. L.; Poston, J. W.; Booth, R. S.; Clark, F. H. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Radiation exposure to the general population due to the operation of controlled thermonuclear reactors is estimated based on current information. Topics covered include: neutron activation products, localized tritium behavior and global tritium circulation. (GHT)

16832 (SAND-74-8682) TRITIUM REMOVAL: A PRELIMINARY EVALUATION OF SEVERAL GETTERS. Schoenfelder, C. W.; West, L. A. (Sandia Labs., Livermore, Calif. (USA)). Nov 1975. Contract AT(29-1)-789. 34p. Dep. NTIS $4.00.

The removal of hydrogen isotopes from flowing gas streams is an important aspect of CTR technology for both decontamination and tritium recovery from plasma exhausts. Several getters have been evaluated for their tritium scrubbing potential at the parts per billion level. Measurements of total capacity and dynamic response have been made for barium, erbium, palladium dispersed on molecular sieve, General Electric H-36 (zirconium alloy), Union Carbide Y-993 ($PdMnO_2$), Societa Apparecchi Elettrici e Scientifici Getters ST101 (Zr–Al), ST171, and ST181, and a Sandia developed organic material, dimerized phenyl propargyl ether (DPPE). Preliminary flow studies were conducted by passing mixtures of either hydrogen or deuterium diluted with argon through packed beds containing the getter and periodically sampling the effluent with a gas chromatograph sensitive to 500 ppB H_2. The results of this work, similar flow experiments using tritium and total capacity measurements are presented in the text. (auth)

16833 (UCRL-77259) LEAK HUNTING PROBLEMS ASSOCIATED WITH CONTROLLED THERMONUCLEAR FUSION EXPERIMENTS. Batzer, T. H.; Murphy, J. J. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 25 Aug 1975. 26p. (CONF-751163-1). Dep. NTIS $4.50.

From 22nd national vacuum symposium of the American Vacuum Society; San Diego, California, United States of America (USA) (18 Nov 1975).

The LLL 2xIIB experiment is briefly described. The vacuum system uses mercury diffusion pumps and titanium sublimation. The base pressure of the guard vacuum is about 10^{-5} torr and about 2×10^{-7} torr in the high vacuum space using the diffusion pumps only. After titanium sublimation, the high vacuum pressure drops into the 10^{-9} torr range. A procedure for leak testing using a special sniffer probe is described. (MOW)

16834 FUSION REACTOR. Brennan, M. H. (Flinders Univ. of South Australia, Bedford Park). pp 115-125 of Physics and the Energy Industry. Summer School in Physics. Bedford Park, South Australia; Flinders University (1974).

From summer school on physics and the energy industry; Bedford Park, Australia (Jan 1974). See CONF-740137–.

Basic principles of the fusion reactor are outlined. Plasma heating and confinement schemes are described. These confinement systems include the linear Z pinch, magnetic mirrors and tokamaks. A fusion reactor is described and a discussion is given of its environmental impact and its fuel situation. (AT)

16835 FIXING OF CHARACTERISTIC POINTS AS A METHOD OF MAINTAINING A GIVEN TOPOLOGY FOR AN EQUILIBRIUM PLASMA CONFIGURATION. Zakharov, L. E. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 71-74(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

One of the methods of controlling the cross-section position and shape of an equilibrium plasma column in Tokamaks of noncircular cross-section is analysed. This method may be taken as the basis of an automatic system for maintaining equilibrium with a given topology of external magnetic surfaces, including configurations with axially symmetric diverters. (auth)

16836 EFFECTIVENESS OF A THERMONUCLEAR SYSTEM OF THE "θ-PINCH-AND-LINER" TYPE. Alikhanov, S. G.; Konkashbaev, I. K. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 123-126(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The effect of compressibility of the liner material on the effectiveness of the θ-pinch-and-liner system is considered. Numerical calculations are made for the compression dynamics of the liner, the results of which are represented by approximate expressions. (auth)

16837 THERMONUCLEAR LASER TARGETS WITH LARGE ENERGY GAIN COEFFICIENTS. Afanas'ev, Yu. V. (Lebedev Inst. of Physics, Moscow); Basov, N. G.; Volosevich, P. P. Nucl. Fusion; Suppl.: 119-121(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Thermonuclear laser targets, based on the principle of compression with weak sensitivity to the shape of the laser pulse, containing a relatively large mass of nuclear fuel, and possessing a large energy gain coefficient ($\gtrsim 100$) are considered. Examples of numerical calculations of compression and combustion hydrodynamics are given for an energy range of 10^4 to 10^8 J. (auth)

16838 EXPERIMENTAL STUDIES ON THE INTERACTION OF LASER RADIATION WITH PLASMA IN MISHEN'-1 AND MISHEN'-2 DEVICES. Aleksandrov, V. V. (Inst. of Atomic Energy, Moscow); Borzenko, V. L.; Burdonskii, I. N. Nucl. Fusion; Suppl.: 113-117(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The paper describes the optical circuit of the laser system of the Mishen'-2 device on neodymium glass. With this circuit it is possible to obtain an energy of ~1 kJ in a time-shaped laser pulse. Powerful amplifier stages with active elements of rectangular cross-section were used at the output of the system. The construction of the interaction chamber is described. It includes a focusing system, a target unit and elements of diagnostic apparatus. The paper discusses the results of prognostic numerical experiments demonstrating the possibility of attaining an ~100-fold compression of solid target material in a unidimensional plane geometry. The experimental data obtained in the Mishen'-2 device are compared with theoretical models. The spectra of scattered radiation were studied in the Mishen'-1 device with an energy of up to 100 J in a short pulse of nanoseconds duration. Experimental data obtained by various means of observation are compared. The possible mechanisms of nonlinear interaction between a laser beam and a high density high-temperature plasma are discussed. (auth)

16839 EFFECT OF CORRUGATION OF THE LONGITUDINAL MAGNETIC FIELD ON THE ION COMPONENT OF PLASMA IN TOKAMAKS. Petrov, M. P. (Ioffe Physico-Technical Inst., Moscow). Nucl. Fusion; Suppl.: 7-11(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

Experimental results are given of measurements of the flux distributions of charge-exchange atoms in the plasma cross-section of Tokamak devices T-3, T-4 and T-6. The observed asymmetry in the distribution of high-energy atoms ($E \gtrsim 1$ keV) is shown to be connected with a drift of ions trapped in the corrugations of the longitudinal magnetic field in the Tokamaks. A comparison of experimental and theoretical data shows that in Tokamaks with a relative corrugation of $\delta \gtrsim 1\%$ (averaged over the plasma cross-section) the ions trapped in the corrugations (the so-called locally trapped ions) withdraw a considerable amount of energy from the ion component of the plasma. (auth)

16840 90° THOMSON-SCATTERING APPARATUS FOR THE ALCATOR DEVICE. Ascoli-Bartoli, U.; Brusadin, A.; Cecchini, A.; De Angelis, A.; Garosi, F.; Grilli, E.; Marchetti, R.; Marconero, R.; Pieroni, L.; Segre, S. E. (EURATOM-CNEN, Frascati, Italy). Nuovo Cim., 30B: No. 1, 87-107(11 Nov 1975).

We describe the structure and performance of the apparatus built for the measurement of electron temperature and density by means of Thomson scattering of laser light on the plasma of the Alcator device at M.I.T. Examples of measurements are reported.

16841 PERTURBATION OF A MAGNETIC FIELD DURING THE BREAK-UP INSTABILITY IN TOKAMAK-6. Vlasenkov,

V. S.; Leonov, V. M.; Merezhkin, V. G.; Mukhovatov, V. S. (Atomic Energy Inst., Moscow). Nucl. Fusion; Suppl.: 1-5(1975).

From 5th conference on plasma physics and controlled nuclear fusion research; Tokyo, Japan (11 Nov 1974).

The results of measuring perturbations in a poloidal field during the development of the break-up instability in the Tokamak-6 are presented. The following discharge parameters were applied: plasma current $I \simeq 50$ kA, longitudinal magnetic field strength $H_0 = 5-6$ kOe, $2 < q(a) < 3$. It was demonstrated that the break-up instability was accompanied by large-scale perturbations in the magnetic field, associated with distortion in the shape of the plasma column. In the vicinity of the discharge chamber walls, the amplitude was about 20% of that of the unperturbed field. It was also shown that the structure of these perturbations underwent substantial changes during the development of the instability. (auth)

16842 FUSION–FISSION HYBRID CONCEPTS FOR LASER-INDUCED FUSION. Maniscalco, J. (Univ. of California, Livermore). Nucl. Technol.; 28: No. 1, 98-107(Jan 1976).

Fusion-fission hybrid concepts are viewed as subcritical fission reactors driven and controlled by high-energy neutrons from a laser-induced fusion reactor. Blanket designs encompassing a substantial portion of the spectrum of different fission reactor technologies are analyzed and compared by calculating their fissile-breeding and fusion-energy-multiplying characteristics. With a large number of different fission technologies to choose from, it is essential to identify more promising hybrid concepts that can then be subjected to in-depth studies that treat the engineering safety, and economic requirements as well as the neutronic aspects. In the course of neutronically analyzing and comparing several fission blanket concepts, this work has demonstrated that fusion-fission hybrids can be designed to meet a broad spectrum of fissile-breeding and fusion-energy-multiplying requirements. The neutronic results should prove to be extremely useful in formulating the technical scope of future studies concerned with evaluating the technical and economic feasibility of hybrid concepts for laser-induced fusion. (auth)

16843 THERMONUCLEAR ENERGY. Braams, C. M. (FOM-Inst. for Plasma Physics, Jutphaas, The Netherlands). pp Paper 4.1-11, 19p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910–P4.

The D–T–Li cycle is evaluated as a potential source of energy. The need to utilize Li inventories is indicated. The parameters describing magnetic and inertial thermonuclear confinement schemes are reviewed; in particular, the burning temperature, the confinement time as expressed by the Lawson criterion, and the technically and economically feasible range of fuel densities. (MOW)

16844 CRITICAL HIGH DENSITY FISSION–FUSION PLASMAS. Winterburg, F. (Univ. of Nevada, Reno). Beitr. Plasmaphys.; 15: No. 2, 71-82(1975).

The implosion-induced compression of a pellet consisting of fissionable material, such as ^{233}U, ^{235}U or ^{239}Pu, to high densities by a laser-, relativistic electron-, or ion-beam is expected to lead to very small critical masses which can be furthermore substantially reduced by simultaneously compressing the pellet together with a neutron reflector. This method opens the prospect for micro-fission-explosions to be used for controlled power production as for a safe fast breeder reactor or for rocket propulsion. Furthermore, if the neutron reflector consists of thermonuclear material, such as T–D, the method can be used for the controlled release of thermonuclear energy. There the fission chain reaction not only will assist in the ignition of the thermonuclear reaction but in turn the fusion neutrons will accelerate the fission chain reaction to a very fast pace. In this case therefore, the fission chain reaction and the fusion thermonuclear reaction are coupled together with an expected greatly increased energy output. (auth)

16845 TIME ISOLATION HIGH-VOLTAGE IMPULSE GENERATOR. Chodorow, A. M. (Data Design Labs., Cucamonga, CA). Proc. IEEE (Inst. Electr. Electron. Eng.); 63: No. 7, 1082-1084(Jul 1975).

Lewis' high-voltage impulse generator is analyzed in greater detail, demonstrating that voltage between adjacent nodes can be equalized by proper selection of parasitic impedances. This permits improved TEM mode propagation to a matched load, with more faithful source waveform preservation. (auth)

16846 COMPARATIVE ENERGETICS OF THREE FUSION-FISSION SYMBIOTIC NUCLEAR REACTOR SYSTEMS. Gordon, C. W.; Harms, A. A. (McMaster Univ., Hamilton, Ontario (Canada). Dept. of Engineering Physics). Nucl. Eng. Des.; 34: No. 2, 269-280(Nov 1975).

The energetics of three symbiotic fusion-fission nuclear reactor concepts are investigated. The fuel and power balances are considered for various values of systems parameters. The results from this analysis suggest that symbiotic fusion-fission systems are advantageous from the standpoint of economy and resource utilization. (NL)

16847 NUMERICAL ANALYSIS OF PULSATING EVAPORATION OF CONDENSED MATTER UNDER THE ACTION OF LASER RADIATION. Kozlov, B.M.; Samokhin, A.A.; Uspenskii, A.B. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 9, 1120-1121 (Sept 1975).

A simple model is used in analysis of pulsating evaporation observed during interaction of laser radiation with the surface of an absorbing substance. The pulsations are due to the instability of the metastable state of an overheated liquid phase. Explosive breakup of the metastable phase is described as the appearance of a new evaporation front at the moment when the temperature reaches the overheating limit. A numerical solution of the boundary-value problem of heat conduction in the region of the moving front shows that, according to this model, the process of establishment of the pulsation period is nonmonotonic: the shortest interval is between the first and second explosions after the beginning of illumination. (auth)

16848 FUSION REACTORS. Kadomtsev, B.B. (I. V. Kurchatov Institute of Atomic Energy, Moscow); Fowler, T.K. Phys. Today 28: No. 11, 36-45 (Nov 1975).

The broad and well-balanced Soviet program on magnetic confinement of thermonuclear plasma inlcudes research on tokamaks, stellarators, open-ended mirror machines and pulsed reactors. (auth)

16849 PRODUCTION OF INTENSE DEUTERON BEAMS. Golden, J.; Kapetanakos, C.A. (Naval Research Laboratory, Washington, D.C. 20375). Appl. Phys. Lett. 28: No. 1, 3-4 (1 Jan 1976).

Results are reported on the production of 400-keV 50-nsec-duration 1.3-kA deuteron beams using a reflex triode. (auth)

16850 APPLICATIONS OF SUPERCONDUCTIVITY IN THE CONTROLLED THERMONUCLEAR RESEARCH PROGRAM. Hess, G. K. Jr.; Ziurys, E. J.; Beard, D. S. (Atomic Energy Commission, Washington, DC). IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 135-140(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Applications of superconductivity will be needed in each of the three magnetic confinement systems being developed in the ERDA controlled thermonuclear research program. Fusion plasmas must be confined by magnetic fields instead of solid walls. The tokamak and magnetic mirror confinement systems will need superconducting magnets to produce the confining magnetic field. The theta-pinch confinement system will need superconducting energy storage coils and homopolar machines to provide energy for pulsed magnetic fields. ERDA is supporting developments for these three systems but it is not yet known which magnetic confinement systems will be used in fusion power reactors. The technology problems associated with these applications of superconductivity are described. (auth)

16851 MULTIFILAMENTARY Nb_3Sn CONDUCTOR FOR FUSION RESEARCH MAGNETS. Fietz, W. A. (Intermagnetics General Corp., Guilderland, NY); Henning, C. D.; Scanlan, R. M. IEEE Trans. Magn.; MAG-11: No. 2, 299-302(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

In an attempt to meet the eventual needs of fusion magnets, a multifilamentary Nb_3Sn conductor was proposed consisting of a cabled array of multifilamentary Nb_3Sn strands 0.027 cm in diameter, surrounding a stainless steel core. This cable assembly would be jacketed with soft copper to provide an overall rectangular exterior. For the purpose of testing this concept, a prototype cable was fabricated in a length of several hundred meters. The cable was designed to carry 300 amperes at 12 T and have a minimum bending radius of about 6 cm. Fabrication techniques, short sample critical currents and bending test results are presented, and the problems anticipated in scale up are discussed. (auth)

16852 10 kA, 300 kJ MAGNETIC ENERGY TRANSFER AND STORAGE (METS) TEST FACILITY. Swannack, C. E.; Blevins, D. J.; Harder, C. R.; Lindsay, J. D. G.; Rogers, J. D.; Weldon, D. M. (Los Alamos Scientific Lab., NM). IEEE Trans. Magn.; MAG-11: No. 2, 504-507(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The theta-pinch fusion test reactor proposed within the controlled thermonuclear research program at the Los Alamos

Scientific Laboratory will demand that approximately 250 MJ be delivered into the plasma compression coil in one millisecond at a repetition rate of four per hour. Multiple modules of superconducting inductive storage will supply this pulsed energy. A Magnetic Energy Transfer and Storage (METS) facility has been constructed to test low-loss superconducting inductive energy storage modules, superconducting switches, and developmental high voltage circuit breakers. The storage module has been tested to 12.5 kA with 386 kJ stored energy. (auth)

16853 300-kJ PULSED SUPERCONDUCTING ENERGY STORAGE COIL. Punchard, W. F. B. (Magnetic Corp. of America, Waltham, MA). IEEE Trans. Magn.; MAG-11: No. 2, 508-511(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The design of a 300 kJ superconducting pulsed energy storage coil is reported. The coil is a solenoid and will operate at a central flux density of 2.0 Wb/m^2 and a current of 10 kA. The critical current, as measured by extrapolation along the peak field load line, is 15 kA. The structure, which is completely non-conducting, was designed mechanically so that the coil may be operated at 12 kA. The windings are partially potted and are cooled on one face of the braid. The coil was designed to remain superconducting throughout the 10 s charge period and the 2 ms discharge period. The repetition period is 30 s. (auth)

16854 PROGRAM FOR DEVELOPMENT OF TOROIDAL SUPERCONDUCTING MAGNETS FOR FUSION RESEARCH. Long, H. M.; Brown, R. L.; Derby, R. W.; Kernohan, R. H.; Lubell, M. S.; Luton, J. N.; Walstrom, P. L. IEEE Trans. Magn.; MAG-11: No. 2, 512-518(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Toroidal fusion devices will require superconducting magnet systems of greater size and complexity than heretofore constructed. A program employing the talents of a number of organizations for the development of superconducting magnets for toroidal fusion devices has been inaugurated. The objective of this program is to demonstrate the suitability and reliability of toroidal superconducting magnets for fusion research devices and experimental power reactors (EPR) in a time compatible with the AEC Controlled Thermonuclear Research (CTR) program goal for EPR construction during early 1980's. Since much of the superconductivity expertise resides now in AEC laboratories, the focus of the program is in these laboratories, but industrial and consultative participation is an integral part of the plan. (auth)

16855 25 TESLA HYBRID MAGNET. Cheremnykh, P. A. (Atomic Energy Inst., Moscow); Churakov, G. F.; Rozhdestvenski, B. V.; Samoilov, B. N.; Chernoplekov, N. A. IEEE Trans. Magn.; MAG-11: No. 2, 519-520(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A hybrid solenoid generating a stationary field up to about 25T in a 28 mm working bore is described. The inner section of the hybrid system represents a conventional water-cooled coil, while the outer coil is made of a superconductor. Some of the insulation and power supplies for the magnet are described. (MOW)

16856 MECHANICAL FORCES IN SUPERCONDUCTING WINDINGS OF TOROIDAL MAGNET SYSTEMS. Gauster, W. F.; Stoddart, W. C. T. IEEE Trans. Magn.; MAG-11: No. 2, 521-523 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A new computer code is briefly described which can be advantageously applied to superconducting toroidal systems with complicated coil shapes. The guiding idea is to use the same geometry for the current elements and the stress model. Furthermore, a short review shows that more work is necessary for elucidating the influence of mechanical stress on the critical current density of the superconductors and on the physical properties of the non-superconducting stabilizing material. Values for the centripetal force acting on each torus coil can be easily calculated when the "1/r approximation" for the magnetic flux density is assumed. The influence of the magnetic flux leaking out between the coils is discussed and it is shown that for tori with large numbers of coils (say, 32 to 64) and with not too large aspect ratios (say, 1.5 to 2) the above mentioned approximation for the calculation of the centripetal forces yields values which are only a few percent too large. Finally, the consequence of a coil failure in a toroidal magnet is discussed under the assumption that each superconducting coil operates in persistent mode. Due to the re-arrangement of the currents and of the magnet fields, centripetal forces and perpendicular force components result whose asymptotically reached values are appreciably larger than the static values calculated for a torus with one coil missing. (auth)

16857 TEST RESULTS OF Nb_3Sn RIBBONS FOR THE PRINCETON D COIL TEST PROGRAM. Kaugerts, J.; File, J.; Willard, J. W. (Princeton Univ., NJ) Contract AT(11-1)-3073. IEEE Trans. Magn.; MAG-11: No. 2, 524-527(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A previously described D coil test program has been modified. Details of a smaller Nb_3Sn D coil test program are described. Cusp coil tests were made with several Nb_3Sn composite ribbons. Measurements of both the quench and recovery currents as a function of magnetic field component perpendicular to the wide edge of the ribbon are presented. (auth)

Wave Phenomena

Refer also to abstract 16775.

16858 BOUNDARY FREQUENCIES OF IONIC WAVES IN PLASMA WAVE GUIDES WITH CONDUCTING WALLS. Kurilko, P. I.; Shvets, O. M. (Physico-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 5, 853-855(May 1975). (In Russian)

The boundary frequencies of natural waves of a homogeneous plasma cylinder of infinite length, placed in a conducting chamber with longitudinal magnetic field, were calculated. Modes with different actual symmetries were examined. It was shown that in the case of complete population of the chamber by the plasma an inversion effect of the boundary frequencies was observed. The boundary frequencies for H waves with one variation along the azimuth are less than for symmetrical H waves. (tr-auth)

16859 QUANTUM WAVES IN AN HOMOGENEOUS ELECTRON PLASMA. Dzhamalov, R. D.; Kolesov, V. V. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 4, 1203-1207(Oct 1975). (In Russian)

Dispersion relations for arbitrary nonpotential waves of a collisionless electron plasma in a quantized magnetic field are derived on basis of the quantum dielectric permeability tensor. The frequency spectra and logarithmic decrement of essentially quantum waves are investigated. The quantum and classical spectra are compared. (auth)

16860 NONLINEAR THEORY OF SURFACE ELECTROMAGNETIC WAVES IN AN IONIZING PLASMA. Boev, A. G.; Prokopov, A. V. (Inst. of Radio Physics and Electronics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 4, 1208-1217 (Oct 1975). (In Russian)

A nonlinear theory of propagation of high frequency surface electromagnetic waves with an amplitude sufficient for ionizing the gas is developed for plasma half-space. The dependence of the dispersion characteristics of the wave and field structure on field amplitude and exponent in the ionization power law is analyzed on basis of an exact solution of the nonlinear Maxwell equations for an exponential dependence of electron concentration on electric field strength. It is shown that with increase of wave amplitude the transparency region boundary is shifted to higher frequencies. Wave propagation in this case is possible only for an amplitude which exceeds a certain threshold value for the given frequency. The case is considered of a plasma with an initial electron concentration which exceeds the critical value for the wave frequency. (auth)

16861 EXPERIMENTAL INVESTIGATION OF THE EVOLUTION OF A NONLINEAR WAVE EXCITED BY A MODULATED ELECTRON BEAM IN A PLASMA. Gladkii, A. M.; Kovalenko, V. P. (Inst. of Physics, Kiev). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1617-1623(Nov 1975). (In Russian)

The spatial evolution of an anharmonic profile of an electric field wave in a beam-plasma system is studied experimentally and the dynamics of electron bunches is discussed on the basis of the results obtained. Variability of the bunch structure and in particular its splitting into many parts, previously predicted, is observed. It is found that alteration of the intial wave profile grows on decrease of the ratio of modulation frequency to plasma frequency. Direct experimental data are obtained on the radial high frequency fields in a system. (auth)

16862 DEFORMATION OF PLASMA RESONANCE REGION IN A STRONG HIGH FREQUENCY FIELD. Gil'denburg, V. B.; Fraiman, G. M. (Scientific-Research Radiophysical Inst., Gorky, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1601-1606(Nov 1975). (In Russian)

Stationary deformation of the plasma resonance region induced by the ponderomotive force of a longitudinal high frequency field is calculated. It is shown that with growth of the field amplitude the energy which is transformed into a runaway longitudinal wave, decreases. (auth)

16863 EFFECT OF SCATTERING BY MAGNETOHYDRODYNAMIC OSCILLATIONS AND THE POWER LAW SPECTRA OF RELATIVISTIC ELECTRONS PRODUCED IN A TURBULENT PLASMA. Nikolaev, Yu. A.; Tsytovich, V. N. (Moscow Engineering-Physics Inst.). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1634-1639 (Nov 1975). (In Russian)

The quasistationary energy spectrum of relativistic electrons interacting with radiation in a turbulent plasma is investigated by taking into account diffusion. It is shown that diffusion in a magnetic field is determined by scattering by magnetohydrodynamic plasma oscillations and the particle spectrum can be described by a power law $\sim\epsilon^{-\gamma}$. An equation is derived for the spectrum exponent γ which depends on the plasma turbulence parameters and on the characteristic size of inhomogeneity of the fast electron distribution. All solutions of the equation are found to lie in the range $2 < \gamma < 3$. (auth)

16864 DISPERSION RELATION FOR ELECTRON WAVES PROPAGATING IN AN ISOTROPIC PLASMA CONTAINING MAXWELLIAN AND SUPRATHERMAL ELECTRONS. Sanmartin, J. R. (Instituto Nacional de Tecnica Aerospacial, Madrid). J. Plasma Phys.; 14: No. 1, 7-17(Aug 1975).

The paper discusses the dispersion relation for longitudinal electron waves propagating in a collisionless, homogeneous isotropic plasma, which contains both Maxwellian and suprathermal electrons. It is found that the dispersion curve, known to have two separate branches for zero suprathermal energy spread, depends sensitively on this quantity. As the energy half-width of the suprathermal population increases, the branches approach each other until they touch at a connection point, for a small critical value of that half-width. The topology of the dispersion curves is different for half-widths above and below critical; and this can affect the use of wave-propagation measurements as a diagnostic technique for the determination of the electron distribution function. Both the distance between the branches and spatial damping near the connection frequency depend on the half-width, if below critical, and can be used to determine it. The theory is applied to experimental data. (auth)

16865 INTERACTION OF WAVE BEAMS IN PLASMA. Giles, M. J. (Sussex Univ., Brighton, Eng.). J. Plasma Phys.; 14: No. 1, 19-24(Aug 1975).

Two non-parallel beams are considered that interact in a plasma and excite a wave that travels across their region of intersection. The dependence of the amplitude of the excited wave is determined for the limiting cases of large and small values of the ratio of the initial beam intensities. (auth)

16866 SECOND-HARMONIC RESONANCE FOR NONLINEAR HYDROMAGNETIC WAVES. Matsumoto, Y.; Sugimoto, N.; Inoue, Y. (Osaka Univ., Toyanaka, Japan). J. Plasma Phys.; 14: No. 1, 53-64(Aug 1975).

Second-harmonic resonance for weakly nonlinear hydromagnetic waves travelling in a cold collisionless plasma is investigated by the method of multiple scales. It is found that the second-harmonic resonance can occur between the magnetoacoustic modes; but it can occur neither between the magnetoacoustic and the Alfven modes, nor between the Alfven modes. The resonant frequency of the magnetoacoustic modes is characterized by the geometric mean of the ion and electron Larmor frequencies. Steady-state solutions are obtained to the dynamical equations governing the second-harmonic resonance. The result of analysis shows that the envelopes of the two resonant waves are composed of two periodic wave-trains, two solitary pulses or a solitary pulse and a phase jump. The problem is also extended to more general dispersive wave systems. (auth)

16867 SHOCK REFLECTION AND SHOCK-WAVE INTERACTION IN FIELD-ALIGNED FLOWS. Natter, M. (Stuttgart Univ.). J. Plasma Phys.; 14: No. 1, 39-51(Aug 1975).

This paper considers the steady two-dimensional problem of regular reflection and symmetric intersection of oblique magnetogasdynamic shock waves. It is assumed that the fluid medium is a non-viscous, non-heat-conducting, ideal gas of infinite electrical conductivity, and that the applied magnetic field is parallel to the velocity of the approaching stream. In view of the complexity of the shock relations, a graphical method is presented for determining the orientation and strength of the reflected shock wave in terms of the Laval number M_1^* (flow speed divided by critical sound speed), the Alfven number A_1 (flow speed divided by Alfven speed), and the shock angle θ_1 ahead of the incident shock. Moreover, the possible ranges of M_1^*, A_1 and θ_1, for which regular reflection may occur, are calculated and illustrated graphically for the case of a monatomic gas. (auth)

16868 DRAG EFFECTS ON RESONANT INTERACTION BETWEEN PARTICLES AND A LANGMUIR WAVE IN AN INHOMOGENEOUS PLASMA. Istomin, Ya. N.; Karpman, V. I.; Shklyar, D. R. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 3, 909-920(Sep 1975). (In Russian).

Acceleration (or deceleration) of electrons due to their nonlinear resonant interaction with a monochromatic Langmuir wave in an inhomogeneous plasma is studied. A change in particle velocity $\overline{\Delta v}$ is observed on passage of the particle through the region of resonant interaction with the wave. A fundamental role in this case is played by a dimensionless parameter β which is proportional to the wave amplitude and inversely proportional to acceleration of the phase velocity (i.e., density gradient). It is shown that $\overline{\Delta v} \neq 0$ for untrapped particles only if $|\beta| > 1$, the sign of $\overline{\Delta v}$ being opposite to that of acceleration of the trapped particles which is identical to phase acceleration (for $|\beta| \leq 1$ the wave cannot trap particles). An expression is obtained for the mean nonlinear change of the distribution function due to dragging of particles by the wave. It is shown that an additional particle current does not arise (in the stationary case) but, generally speaking, the concentration is altered by the wave. The integral particle energy flux due to dragging effects is also calculated. (auth)

16869 TOTALITY OF WAVES IN A HOMOGENEOUS VLASOV PLASMA. Puri, S.; Leuterer, F.; Tutter, M. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.). J. Plasma Phys.; 14: No. 1, 169-178(Aug 1975).

An attempt is made to trace the physical origin of the complex roots of the dispersion relation for a Maxwellian, non-relativistic, homogeneous, magnetized Vlasov plasma. For simplicity, the identification process is performed for the case of propagation perpendicular to the magnetic field. For a given real w, there are infinitely many complex roots, in addition to a finite number of propagating solutions. The propagating waves correspond (in addition to the cold-plasma waves) to either the extraordinary Gross-Bernstein (Gross, E. P., 1951, Phys. Rev. 82, 232) (Bernstein, I. B., 1958, Phys. Rev. 109, 10) mode propagating just above the harmonics, or the pair of Dnestrovskij-Kostomarov (Dnestrovskij, Y. N. & Kostomarov, D. P., 1962, Soviet Phys. JETP, 14, 1089) modes (one ordinary and the other extraordinary) propagating just below the harmonics. The hot-plasma solutions asymptotically approach the harmonic frequencies as $k \to \infty$, and analytically continue across the harmonics as complex waves. These complex waves, originating in groups of three from each cyclotron harmonic, apparently remain distinct, giving rise to an infinity of complex roots for a given frequency (since there are an infinite number of cyclotron harmonics). Detailed analysis reveals that, for the ordinary and the extraordinary Dnestrovskij-Kostomarov modes, electric displacement and magnetic induction, respectively, are the dominant field components. (auth)

16870 LANDAU DAMPING OF SURFACE WAVES AT A PLASMA-VACUUM INTERFACE. Clemmow, P. C.; Elgin, J. N. (Cambridge Univ., Eng.). J. Plasma Phys.; 14: No. 1, 179-194 (Aug 1975).

The exact surface-wave dispersion relation is expressed in terms of elementary functions for a plasma characterized by a "resonance" velocity distribution function. An approximate form of the relation is derived for the case when the thermal velocity spread is much less than c. The pure surface wave obtained by dropping the term responsible for Landau damping is compared with that predicted on the basis of a fluid model of the plasma. The effect of Landau damping is then investigated, both by analytic approximations and by computation. Two branches of the solution to the dispersion relation are found; and it is shown that the surface wave suffers increasingly severe damping as the frequency grows beyond $1/\sqrt{2}$ times the plasma frequency. It is argued that qualitatively similar damping would be present were the plasma to have a Maxwellian equilibrium distribution function. (auth)

16871 PLANE WAVE INTERACTION WITH A HOMOGENEOUS WARM PLASMA SPHERE. Ruppin, R. (Israel Atomic Energy Commission, Yavne). Plasma Phys.; 17: No. 10, 723-730(Oct 1975).

A Mie type theory for the scattering and absorption properties of a homogeneous warm plasma sphere is developed. The theory is applied to the calculation of the extinction cross section of plasma spheres, and the effects of Landau damping and collisional damping on the spectra are discussed. The dependence of the main resonance and of the Tonks-Dattner resonances on the physical parameters characterizing the sphere and its surroundings is investigated. The spectrum is shown to be insensitive to the boundary conditions which specify the behavior of the electrons at the surface of the sphere. (auth)

16872 QUASI-STATIC MODES OF OSCILLATION OF A COLD TOROIDAL PLASMA. Love, J. D. (Oxford Univ.). J. Plasma Phys.; 14: No. 1, 25-37(Aug 1975).

The normal modes of oscillation of a cold dielectric plasma ring are analyzed in the quasi-electrostatic approximation. An exact dispersion relation is derived, valid for all aspect ratios. Its solutions are shown to be extremely close to those of an infinite cylindrical plasma with cross-section equal to the minor cross-section of the ring, when the cylinder is considered as a wavelength-preserving limit of the toroidal geometry. (auth)

16873 EFFECT OF IONIC TEMPERATURE ON PROPAGATION OF ION-ACOUSTIC SOLITARY WAVES IN A COLLISIONLESS PLASMA OF WARM-ION FLUID AND NON-ISOTHERMAL ELECTRONS. Tagare, S. G. (Indian Inst. of Science, Bangalore). J. Plasma Phys.; 14: No. 1, 1-6(Aug 1975).

Using a perturbation technique, Modified Korteweg-de Vries (MKdV) equations are derived for a mixture of warm-ion fluid ($\gamma_i = 3$) and hot and non-isothermal electrons ($\gamma_e > 1$), (i) when deviations from isothermality are finite, and (ii) when deviations from isothermality are small. Stationary solutions are obtained for these equations, and compared with the corresponding solutions for a mixture of warm-ion fluid ($\gamma_i = 3$) and hot, isothermal electrons ($\gamma_e = 1$). (auth)

16874 THREE-WAVE INTERACTIONS IN MAGNETIZED PLASMAS. Larsson, J.; Stenflo, L. (Umea Univ., Sweden). Beitr. Plasmaphys.; 13: No. 3, 169-181(1973).

The nonlinear interaction between three waves in a warm magnetized two-component plasma is studied. A general formalism is developed within a simple macroscopic theory in order to treat waves propagating in arbitrary directions. Some results of previous papers are generalized and discussed. (auth)

16875 PENETRATION OF WEAK ELECTROMAGNETIC RADIATION INTO A SUPERDENSE PLASMA ACTED UPON BY POWERFUL SHORT-WAVE RADIATION. Bunkin, F.V.; Kalinin, F.V. (P. N. Lebedev Physics Institute, USSR Academy of Sciences). JETP Lett. 22: No. 2, 41-42 (20 July 1975).

We consider the possibility of an electromagnetic wave penetrating into a superdense plasma that is simultaneously irradiated by a circularly-polarized wave of higher frequency. The penetration is due to the constant magnetic field induced by the high-frequency wave as a result of the inverse Faraday effect. Quantitative estimates are presented as applied to the case when the two waves are the emissions of a CO_2 and an Nd laser, respectively. (auth)

16876 COUPLING OF SINGLE-PARTICLE AND COLLECTIVE MOTIONS IN A ONE-COMPONENT PLASMA. Gould, H. (Department of Physics, Bar-Ilan University, Ramat Gan, Israel); Mazenko, G.F. Phys. Rev. Lett. 35: No. 21, 1455-1458 (24 Nov 1975).

We perform a microscopic calculation of the memory function of the velocity autocorrelation function in a classical one-component plasma. Our theory yields oscillatory behavior in the velocity autocorrelation function consistent with recent molecular-dynamics computations. We also calculate the self-diffusion coefficient as a function of density. (auth)

16877 EFFECT OF LANGMUIR TURBULENCE ON STIMULATED BRILLOUIN BACKSCATTERING. Guzdar, P.N. (Physical Research Laboratory, Ahmedabad 380 009, India). Phys. Rev. Lett. 35: No. 24, 1635-1637 (15 Dec 1975).

The threshold for stimulated Brillouin backscattering in a weakly inhomogeneous plasma in the presence of a low level of Langmuir turbulence has been estimated. Such background turbulence is found to induce a small space-dependent wave-number mismatch through the modified ion-acoustic-wave dispersion relation, leading to convective saturation of the scattered wave. The threshold values are found to be quite significantly altered compared to those calculated for quiescent plasmas. (auth)

16878 LOCALIZED FIELDS AND DENSITY PERTURBATIONS DUE TO SELF-FOCUSING OF NONLINEAR LOWER-HYBRID WAVES. Gekelman, W.; Stenzel, R.L. (Department of Physics, University of California, Los Angeles, California 90024). Phys. Rev. Lett. 35: No. 25, 1708-1710 (22 Dec 1975).

Large-amplitude lower-hybrid wave bursts at $\omega_0 > \omega_{LH}$ are excited from a grid and propagate into a density gradient perpendicular to B_0. The evolution of the internal rf fields and the plasma parameters is investigated. Above threshold localized field maxima appear ($E_{max} > E_{appl}$) and, simultaneously, strong density perturbations are formed. The nonlinear phenomena are interpreted by ponderomotive-force and space-charge separation effects. (auth)

ENGINEERING

16879 ELASTIC-PLASTIC FINITE ELEMENT ANALYSIS USING SUPERPOSITION. Yagawa, G.; Nishioka, T.; Ando, Y. (Tokyo Univ. (Japan). Faculty of Engineering). Nucl. Eng. Des.; 34: No. 2, 247-254(Nov 1975).

A calculation method using the superposition technique of analytic and finite element solutions is applied to elastic-plastic plane problems. The incremental form of the principle of virtual work is employed to derive the equations, from which the nodal displacements of the finite elements, together with the generalized displacements of the analytic solution, are calculated simultaneously. Several example problems are solved for elastic-plastic material with the use of the von Mises yield criteria and the associated flow rule. The method is effective in giving enough accuracy in strain concentration problems with small numbers of elements. (NL)

16880 LARGE STRAIN, VISCOELASTIC, AND ELASTO-VISCOPLASTIC NUMERICAL ANALYSIS BY MEANS OF THE FINITE ELEMENT METHOD. Kawahara, M. (Chuo Univ., Tokyo (Japan)). Nucl. Eng. Des.; 34: No. 2, 233-246(Nov 1975).

Finite element procedures and illustrative numerical examples for linear and nonlinear viscoelastic and elasto-visco-plastic bodies are discussed. According to the well-known theory in rheology, the constitutive equation of viscoelastic bodies can be described by the first-order simultaneous differential equation system. Using this result, the finite element equation leads to an equation similar to the Hookean elastic body except for the inclusion of the time increment. The procedure is applicable to certain forms of nonlinear viscoelastic and elasto-viscoplastic bodies. To solve the nonlinear simultaneous equation system, it is convenient to employ the incremental displacement method for the nonlinear problems such as large deformation loading, unloading, and cyclic loading behavior. (NL)

Facilities and Equipment

Refer also to abstract 17679.

16881 (AEEW-M-1296) DESIGN AND TESTING OF A SUPERSCREENED CABLE-MM10/75. Fowler, E. P. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). Nov 1975. 21p. Dep. NTIS (US Sales Only) $3.50.

Design features of a superscreened cable in which newly developed techniques for metal tape winding are used to achieve good screening and good flexibility are described. These are applied to a general purpose low noise (anti-microphonic) cable which has an onerous mechanical specification. Test results on production samples are given before and after mechanical working. (auth)

16882 (BDX-613-1354(Rev.)) PROCESS ACCEPTANCE AND ADJUSTMENT TECHNIQUES FOR SWISS AUTOMATIC SCREW MACHINE PARTS. Final Report. Robb, J. M. (Bendix Corp., Kansas City, Mo. (USA)). Jan 1976. Contract AT(29-1)-613. 25p. Dep. NTIS $4.00.

Product tolerance requirements for small, cylindrical, piece parts produced on swiss automatic screw machines have progressed to the reliability limits of inspection equipment. The miniature size, configuration, and tolerance requirements (plus or minus 0.0001 in.) (0.00254 mm) of these parts preclude the use of screening techniques to accept product or adjust processes during setup and production runs; therefore, existing means of product acceptance and process adjustment must be refined or new techniques must be developed. The purpose of this endeavor has been to determine benefits gained through the implementation of a process acceptance technique (PAT) to swiss automatic screw machine processes. PAT is a statistical approach developed for the purpose of accepting product and centering processes for parts produced by selected, controlled processes. Through this endeavor a determination has been made of the conditions under which PAT can benefit a controlled process and some specific types of screw machine processes upon which PAT could be applied. However, it was also determined that PAT, if used indiscriminately, may become a record keeping burden when applied to more than one dimension at a given machining operation. (auth)

16883 (CNLM-289) MACHINING OF ELONGATED SLOTS IN THE QUARTER SECTION RADIATOR WITH THE "JIFFY" DISINTEGRATOR. Final Report. Asmond, L. H. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 4 Oct 1957. 6p. Dep. NTIS $3.50.

The "Jiffy" disintegrator requires molybdenum electrodes in its operation. Due to the lack of this material, round electrodes which were purchased with the equipment, were utilized in our test. The amount of oxidation, depth of heat affected zone, surface finish and the estimated time to machine each test specimen were used as a basis for evaluating the "Jiffy" disintegrator. The "Jiffy" machine operates at one speed which does not allow for a controlled surface finish. Many operating difficulties were encountered in adapting this equipment and the finished test specimen could not pass metallurgical test. In view of these facts it is felt that this type of machining operation does not meet the requirements. (auth)

16884 (CNLM-1284) WELD, HIGH-PRESSURE SEAL WELD ON PROPOSED FLEX SEAL ASSEMBLY. Bessette, R. J. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 15 Sep 1958. 6p. Dep. NTIS $3.50.

To reduce the expense of replacing extensive machined parts in a Flex Seal Assembly containing a metal bellows, it was suggested that two seal welds be made at pertinent locations enabling the bellows to be an independent component capable of being removed without disturbing the remaining components. Four details were fabricated simulating the proposed Flex Seal Assembly and subsequently welded to determine the feasibility of acquiring two such high-pressure fusion welds. (auth)

16885 (CNLM-1312) DEVELOPMENT OF UNIVERSAL ELOX MACHINE (603 RADIATOR). Final Report. Asmond, L. H. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 5 Nov 1958. 9p. Dep. NTIS $3.50.

Conventional machining methods were attempted without success. Test specimens fabricated on the electrical discharge machine (Standard M-500 Elox) proved satisfactory, indicating the necessity for designing and developing a unit that would successfully produce angular slots on a production basis. (auth)

16886 (CNLM-5692) PRELIMINARY PROPOSAL FOR JET-CENTRIFUGAL PUMP INVESTIGATION IN HIGH TEMPERATURE LIQUID METAL AND/OR IMPELLER RESEARCH. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). [nd]. 27p. Dep. NTIS $4.00.

A proposal is made for testing a jet-centrifugal pump in 1400°F potassium following optimization of the jet-pump design using water test data. (LCL)

16887 (CNLM-5693) PRELIMINARY PROPOSAL FOR DYNAMIC AND FACE SEAL INVESTIGATIONS FOR HIGH TEMPERATURE LIQUID METAL APPLICATIONS. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). [nd]. 14p. Dep. NTIS $3.50.

A program of high speed dynamic seal development is proposed to determine the characteristics of shaft seals for space power plant equipment operating at shaft speeds in excess of 10,000 rpm. These tests will be run in water with final tests to be conducted in high temperature liquid metals. The liquid metal test will be run with a face seal for vapor sealing. A parallel program on face seals will be conducted to determine the most efficient contour of the sealing surface. This program will also increase the life expectancy and reliability of these seals. The most promising face seal will be used in the liquid metal tests mentioned previously. Two tests in liquid metal are suggested. One to seal a motor cavity from space vacuum environment and one to seal between two different liquid metals. The latter test is indicative of the conditions to be experienced in a turbine driven pump. (auth)

16888 RAPID-HANDLING FURNACE FOR SUPERALLOYS. Hope, C. L. Met. Prog.; 108: No. 4, 101(Sep 1975).

A rapid handling furnace for rapid quenching of superalloys such as Rene 41, Hastelloy x and Ti-6Al-4V alloys is described. The furnace is lined with lightweight, fast-heating/cooling insulation which facilitates opening and closing. (JRD)

Lasers

Refer also to abstracts 16760, 17285, 17286, and 18587.

16889 (AD/A-007692) DEVELOPMENT OF OPTICAL COATINGS FOR HIGH-INTENSITY LASER APPLICATIONS. Final Report, December 1970–March 1973. Loomis, J. S. (Arizona Univ., Tucson (USA). Optical Sciences Center). Feb 1975. Contract F29601-71-C-0023. 70p. NTIS $4.25.

Optical coatings for high-intensity 10.6 micrometer laser applications have been developed. Three applications were examined: single-layer protective coatings for KCl and NaCl window, two-layer antireflectance coatings for KCl and NaCl windows, and multilayer high-reflectance coatings for Ge beamsplitters. Good results were obtained for As_2S_3 as a protective coating on NaCl and KCl and (Ge/ZnS) as a multilayer stack n on Ge. Coating deposition techniques are described in some detail as are experimental techniques for spectrophotometric analysis of coating optical properties, calorimetric measurements of absorptance at 10.6 micrometers, and laser damage measurements using cw, 10.6 micrometers radiation. (GRA)

16890 (AD/A-008471) TRANSPORT PROPERTIES OF SELECTED ELEMENTS AND COMPOUNDS IN THE GASEOUS STATE. Final Report. Liley, P. E. (Center for Information and Numerical Data Synthesis, West Lafayette, Ind. (USA)). Jan 1957. 144p. (CINDAS-TPRC-29). NTIS $14.50.

Supersedes Ad-757528 and report dated Dec 1973, AD-782024.

This report presents calculated values of the viscosity, thermal conductivity, and Fickian diffusion coefficient for gases and gas mixtures of interest to laser technology. Tables of viscosity, thermal conductivity, and diffusion coefficient have been prepared for one hundred seven binary mixtures and for nine pure substances, the latter being helium, atomic and molecular hydrogen, atomic and molecular deuterium, atomic and molecular fluorine, hydrogen fluoride, and deuterium fluoride. Most of the binary mixtures are combinations of these substances. The temperature range was from 100 to 3000 K. For the pure substances, the most recent recommendations were used and for the mixtures, the Lennard-Jones 6-12 potential was used for viscosity and diffusion, and a linear mixing rule was employed for thermal conductivity. The precision of the tabulated values is reviewed. The present state-of-the-art in predicting these properties is briefly surveyed. It is concluded that significant discrepancies can still exist between theoretical and experimental quantities. (GRA)

16891 (EUR-CEA-FC-772) MODE STUDY, BEAM CHARACTERISTICS OF A 100 mW cw 337 μm HCN WAVEGUIDE LASER. Belland, P.; Veron, D.; Whitbourn, L. B. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. de Physique du Plasma et de la Fusion Controlee). May 1975. 27p. Dep. NTIS (US Sales Only) $4.00.

The first continuous sub-millimeter waveguide laser operating on the 337 μ HCN line is described. Results of the first comprehensive experimental study of its low-loss modes are presented. The laser cavity is a 5 cm dia, 2.4 m long pyrex tube with plane reflectors (one of them is a metal mesh) against its ends. Eight modes were identified. Intensity distributions in the beam cross section and mode polarization were studied. The results agree with theoretical predictions for dielectric waveguide modes. The propagation of the EH_{11} mode in free space was also studied. The beam propagates as a Gaussian beam at moderate, and large distances from the mesh coupler. The maximum output power of the laser is of the order of 100 mW representing the highest output power unit volume so far reported for a continuous HCN laser. (auth)

16892 (ONERA-NT-216) FLOW WITH VIBRATIONAL ENERGY EXCHANGE, APPLICATION TO CO_2 ELECTRIC LASER. Dahan, C. (Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92 - Chatillon (France)). 1974. 80p. (In French). INIS.

The performances of a continuous wave (CO_2, N_2, He) laser ionized by an electron beam are calculated. Several types of phenomena are considered: energy exchange processes between molecules of laser medium; electron molecular excitation processes; and aerodynamic phenomena. The energy exchanges accompanying the laser effect generate important quantities of heat, which have to be evacuated by the flow. After a survey of the fundamental assumptions on molecular phenomena, a computer code was developed for following, along the flow, the evolution of the thermodynamic parameters (pressure, temperature), of the laser gain, and of the electrical properties (electron density and temperature). To provide a finer description of the last ones, a model giving the energy distribution of the electrons in the laser medium was established. (FR)

16893 (ONERA-NT-238) CALCULATION OF MACROSCOPIC PARAMETERS AND ELECTRON DISTRIBUTION FUNCTIONS IN PLASMAS OF CO_2-N_2-He. Bonnet, J.; Dahan, C.; Fournier, G.; Pigache, D. (Office National d'Etudes et de Recherches Aerospatiales (ONERA), 92-Chatillon (France)). 1974. 41p. (In French). Dep. NTIS (US Sales Only) $4.00.

Data on macroscopic parameters characterizing the electrons in CO_2 laser plasmas are calculated by means of distribution functions. These exact values are compared with those obtained by an approximate method. (auth)

16894 THEORY OF TWO-CHANNEL LASER GENERATION IN SPECTRALLY NON-HOMOGENEOUS MEDIA. IV. Wide-Band Generation. Efimenko, L. V.; Mashkevich, V. S. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 7, 1209-1212(Jul 1975). (In Russian).

A kinetic theory for wide-band laser generation in spectrally inhomogeneous medium in the presence of generation at two irradiation transitions with total upper working level was constructed for the reverse limiting cases of non-correlation and correlation frequency of the individual active centers. The possibility of developing wide-band generation in one of the channels as a function of the form of the generation spectrum in the other and of the character of the correlation of the frequency of the active centers was studied. Criteria for wide-band generation are reported. (tr-auth)

16895 He-Ne RING LASER WITH Ne ABSORPTION CELL. Danileiko, M. V.; Kozubovskii, V. R.; Nedavnii, A. P.; Shpak, M. T. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 5, 834-838(May 1975). (In Russian).

The successful observation of the Ne absorption resonance in the He-Ne ring laser ($\lambda \approx 3.39\,\mu$m) is discussed. This resonance width is less than natural line width and the contrast is up to 20%. The ring gas laser absorption resonance is suggested to be used in superhigh resolution spectroscopy. (auth)

16896 OUTPUT POWER SATURATION IN HIGH CURRENT REGIONS OF DIFFERENT NOBLE-GAS ION LASERS. Boscher, J.; Finzel, R.; Salk, J.; Schafer, G. (Technical Univ., Berlin). Appl. Phys.; 5: No. 3, 203-210(Dec 1974).

Detailed experiments with cw noble gas ion lasers in high current regions are reported. Optimum lasing conditions and saturation behavior of individual laser transitions in singly and doubly ionized argon, krypton, and xenon have been investigated. Various saturation mechanisms are discussed, such as resonance-radiation trapping, collisional deexcitation, multiple ionization, radial and axial gas pumping, and optical degradation of the cavity mirrors. The experimental results indicate that resonance-radiation trapping is the most probable cause of power limitation in noble-gas ion lasers. (Electr. Electron. Abstr.)

16897 CONTRIBUTION TO THE THEORY OF NONLINEAR POWER RESONANCES IN GAS LASERS. Alekseev, V. A.; Andreeva, T. L.; Sobel'man, I. I. (Lebedev Inst. of Physics, Moscow). Sov. Phys.-JETP (Engl. Transl.); 37: No. 3, 413-418 (Sep 1974).

Translated from Zh. Eksp. Teor. Fiz.; 64: No. 3, 813-824 (Mar 1973).

The shape and position of resonances are sensitive to the fine details of interaction mechanisms. Equations are developed to describe non-linear power resonances in gas lasers. It is assumed that perturbations produced by the particles surrounding an atom reduce to time-separated collisions, and a collision integral is obtained that is expressed in terms of exact scattering amplitudes, with allowance for both elastic and inelastic channels. This approach enables investigations to be made of changes in form of non-linear resonances throughout the pressure range of interest. At relatively low pressure the width and shift of the resonances can become non-linear functions of the pressure, and this can be of importance for the stabilization of gas laser frequencies. Among matters discussed are the interaction of an atom with the field of a monochromatic standing wave, the influence of collisions, small angle scattering, and almost isotropic scattering. (Electr. Electron. Abstr.)

16898 USE OF PLASMA ACCELERATOR FOR OPTICAL PUMPING OF LASERS. Kozlov, N. P.; Protasov, Yu. S. (Moscow Tech. Coll.). Sov. Phys.-Tech. Phys. (Engl. Transl.); 19: No. 3, 358-360(Sep 1974).

Translated from Zh. Tekh. Fiz.; 44: No. 3, 575-579(Mar 1974).

Experimental conditions for optimum performance with plasma accelerators as pumps for organic dye lasers are discussed. The efficiency of elliptical reflectors for the system working in a vacuum of 10^{-6} torr is evaluated and can reach 70%. Lasing properties of a Rhodamine 6G laser are studied under these conditions. In principle this technique should enable a laser to be designed to lase in the far ultraviolet range. (Electr. Electron. Abstr.)

16899 TURNABLE DYE LASER WITH DISTRIBUTED FEEDBACK AND A NARROW EMISSION LINE. Efendiev, T. Sh.; Rubinov, A. N. Zh. Prikl. Spektrosk.; 21: No. 3, 526-528(Sep 1974). (In Russian).

A narrow emission line, tunable in the 708 to 766 nm bandwidth, was obtained with a dye laser using distributed feedback. A solution of 1,3,3,1', 3', 3'-hexame-thyl-4,5,4',5'-dibenzoindodecarbocyanine perchlorate in ethanol was used to generate the emission. The halfwidth of the emission line was less than 0.01 nm and the

peak emission power, with a pumping power of 1.7 MW was 0.3 MW. (Electr. Electron. Abstr.)

16900 FREQUENCY TUNABLE RAMAN LASER USING INCLINED POLARITONS. Gyuzalyan, R. N. Zh. Eksp. Teor. Fiz., Pis'ma Red.; 20: No. 1, 48-51(5 Jul 1974). (In Russian).

Observations of stimulated Raman scattering (SRS) using inclined polaritons are presented. The use of SRS with inclined polaritons in a lithium iodate crystal is shown to ensure fine tuning of the first Stokes component frequency in the 100 cm^{-1} bandwidth. (Electr. Electron. Abstr.)

16901 AN OPTICAL DISCRIMINATION AMPLIFIER. Seka, W.; Stussi, E. (Univ., Bern). Opt. Commun.; 12: No. 3, 341-343(Nov 1974).

Measurements on an optical discrimination amplifier are presented which demonstrate its ability to increase the S/N ratio of single ultrashort pulses by 2 to 3 orders of magnitude. The amplifier consists of a series of amplifiers and dye cells such that for each dye-amplifier section the small-signal gain is less than one. (Electr. Electron. Abstr.)

16902 ROLE OF OPTICAL GUIDING IN CRITICAL-TEMPERATURE BEHAVIOUR, DELAYS, AND Q SWITCHING IN SINGLE HETEROSTRUCTURE GaAs/(GaAl)As LASERS. Thompson, G. H. B.; Selway, P. R.; Henshall, G. D.; Whiteaway, J. E. A. (Standard Telecommunication Labs., Ltd., Harlow, Eng.). Electron. Lett.; 10: No. 22, 456-457(31 Oct 1974).

The sharp increase in threshold current in single heterostructure lasers around the critical temperature T_c has been found to be quantitatively related to the measured loss of optical confinement caused by injected carriers. Using this relation, laser quenching below T_c, Q switching and anomalous delays can be attributed, respectively, to catastrophic loss of confinement, momentary restoration of confinement and the interaction of saturable absorbers with the confinement change. (Electr. Electron. Abstr.)

16903 NARROW SPECTRAL LINES IN RING LASER RADIATION. Gnatovskii, A. V.; Danileiko, M. V.; Kozubovskii, V. P.; Rozhdestvenskaya, T. V.; Fedin, V. P.; Shpak, M. T. Ukr. Fiz. Zh. (Ukr. Ed.); 19: No. 11, 1808-1811(Nov 1974). (In Russian).

A new method is suggested for combining absorption and gain lines which is based in the appearance of power resonances of the ring laser in the centers of absorption and gain lines. The obtained ring laser resonance in the line of radiation of active centers are connected with competition of the effect of spectral saturation of lines, spatial burning of the medium and phase interference of the running waves. (Electr. Electron. Abstr.)

16904 MEASUREMENT OF THE EFFECT OF INJECTED CARRIERS ON THE p-n REFRACTIVE-INDEX STEP IN SINGLE HETEROSTRUCTURE DIODE LASERS. Selway, P. R.; Thompson, G. H. B.; Henshall, G. D.; Whiteaway, J. E. A. (Standard Telecommunication Labs., Ltd., Harlow, Eng.). Electron. Lett.; 10: No. 22, 453-455(31 Oct 1974).

Far-field emission patterns of $GaAs/Ga_xAl_{1-x}As$ single heterostructure lasers have been measured over a range of temperature and threshold currents. The pattern width decreases as the threshold increases, which can be interpreted as a reduction of the p-n refractive-index step, owing to the effect of the injected carriers. A quantitative estimate of this effect has been obtained. (Electr. Electron. Abstr.)

16905 INVESTIGATION INTO PASSIVE DARKENING SOLUTIONS IN THE RESONATOR OF A RUBY LASER. Berzing, E. G.; Naboikin, Yu. V.; Rozhanchuk, L. N.; Rom-Krichevskaya, I. A.; Tiunov, A. Zh. Prikl. Spektrosk.; 21: No. 3, 533-536(Sep 1974). (In Russian).

An experimental investigation into the dependence of the damping constant of the ruby laser output emission peaks on the temperature of the passive darkening shutter over the 300 to 400°K range is described. Solutions of 1,3-diphenylbutadiene-1,4 in chloroform and dichloroethane are used as passive darkening shutters. The experimental results may be explained by the variation in the lifetime of the triplet state of the 1,3-diphenylbutadiene-1,4 molecules. The emergence of free oscillations at a certain temperature is due to the modulation caused by the stereoisomerization of the 1,3-diphenylbutadiene-1,4 molecules. (Electr. Electron. Abstr.)

16906 TUNING THE EMISSION FREQUENCY OF AN ARGON LASER BY A MAGNETIC FIELD. Grimblatov, V. M.; Tesel'kin, V. V.; Chulyaeva, F. G. Zh. Prikl. Spektrosk.; 21: No. 3, 537-539 (Sep 1974). (In Russian).

The influence of an axial magnetic field of 0 to 700 Oe strength on the displacement of the emission frequency of a single-frequency argon laser with an emission of $\lambda = 488.0$ nm was studied. The areas of Zeeman frequency tuning are determined as a function of the argon pressure. The emission frequency stability is determined by the heterodyne method and the relative-instability is found to be 10^{-8}. (Electr. Electron. Abstr.)

16907 X-RAY LASERS. Carillon, A.; Jaegle, P.; Jamelot, G.; Sureau, A. (Lab. of Chemical Physics, Orsay, France). Onde Electr.; 54: No. 9, 441-445(Nov 1974). (In French).

The paper discusses two possibilities for the generation of population inversions. Pumping by x-ray photoionization which requires high pumping power is investigated. The alternative method using hot dense plasmas of highly charged ions is discussed at length. Experimental results are presented for the Al^{3+} ions in a laser produced plasma. (Electr. Electron. Abstr.)

16908 USE OF PICOSECOND LASER TO PRODUCE COHERENT X-RAYS. Lacour, B.; Michon, M. (Compagnie Generale d'Electricite, Marcoussis, France). Onde Electr.; 54: No. 9, 474-478(Nov 1974). (In French).

A picosecond laser and some features of the laser plasma interaction are described. It is shown that, with existing lasers, it is possible to ionize almost completely the atoms of the target. Recombinations would then populate metastable states of highly ionized species and allow subsequent amplification in the plasma near 10 Å. (Electr. Electron. Abstr.)

16909 GENERATION OF SINGLE ULTRASHORT LIGHT PULSES WITH THE AID OF A "COMBUSTIBLE" MIRROR. Veduta, A. P.; Fedotov, N. B.; Furzikov, N. P. Sov. J. Quant. Electron. (Engl. Transl.); 4: No. 2, 228-229(Aug 1974).

Translated from Kovantovaya Elektron. (Moscow); 1: No. 2, 408-410(Feb 1974).

It was found possible to increase considerably the initial density of an in-resonator nonlinear absorber by using a mirror whose coating was burnt through during the early stages of laser action. This technique increased the probability of full mode locking in a neodymium laser and shortened the train of ultrashort pulses to a point where they had not yet suffered phase distortion. The system described allowed a reliable selection of single ultrashort pulses with a contrast of ~10. (Electr. Electron. Abstr.)

16910 METAL MONOCRYSTALS AS POSSIBLE DFB X-RAY LASER MATERIALS IN PREPLASMA STATE. Farkas, G.; Horvath, Z. G. (Central Research Inst. of Physics, Budapest). Phys. Lett.; 50A: No. 1, 45-46(4 Nov 1974).

Certain metal monocrystals seem to be convenient materials for distributed feedback x-ray lasers. The relatively long time of thermalization makes the coherent x-ray process possible before the plasma state. (Electr. Electron. Abstr.)

16911 DEPENDENCE OF THE GENERATION SPECTRUM OF A LASER BASED ON AN ETHANOLIC SOLUTION OF RHODAMINE 6G WITH AN EMISSION ENERGY OF ABOUT 100 J ON THE SPECTRAL PUMPING COMPOSITION FOR DIFFERENT DYE CONCENTRATIONS. Barikhin, B. A. Zh. Prikl. Spektrosk.; 21: No. 2, 335-336(Aug 1974). (In Russian).

The dependence of emission wavelength at the moment of generation and at the moment of disruption on the spectral composition was studied at different dye concentrations. The lower working threshold for the generator in the optimal region was reached by filtering out the pumping emission in the uv spectral region by a saturated solution of sodium formate. Loss of emission at the moment of generation disruption is only slightly dependent on spectral composition in this region. (Electr. Electron. Abstr.)

16912 INVESTIGATION INTO THE INTENSITY DISTRIBUTION THROUGH THE CROSS SECTION OF THE BEAM IN A SINGLE-MODE LASER. Abramov, V. Ya.; Leont'ev, V. G.; Sedov, G. S.; Smorchkova, S. A. Zh. Prikl. Spektrosk.; 21: No. 3, 540-542 (Sep 1974). (In Russian).

The radiation intensity distribution through the beam cross section of a helium-neon laser operating in a single mode was investigated. The experimental results are compared with nonfocal resonator theory and it is established that the intensity distribution in semiconcentric-type resonators differs from the theoretical whereas the experimental data for other types of resonators are in good agreement with the theory. This deviation in the nature of the intensity distribution in semiconcentric resonators is shown to be related to the nonuniformity of the amplification factor through the cross section of the active element. (Electr. Electron. Abstr.)

16913 CONDITIONS FOR SELF-EXCITATION OF SURFACE WAVES IN AN ACTIVATED WAVEGUIDE WITH A SINUSOIDALLY CORRUGATED SURFACE. Kiselev, V. A. Sov. J. Quant. Electron. (Engl. Transl.); 4: No. 2, 252-253(Aug 1974).

Translated from Kvantovaya Elektron. (Moscow); 1: No. 2, 441-444(Feb 1974).

The theory of self excitation of E and H waves in an activated thin film waveguide is developed with particular attention to the distributed feedback caused by corrugations. Resonant interactions between waves of different orders are considered. Equations giving the conditions for resonance and self excitation of surface waves are derived. (Electr. Electron. Abstr.)

16914 GAS-DYNAMICS LASER USING PRODUCTS OF COMBUSTION OF NITRO COMPOUNDS. Beletskii, L. K.; Vazyulin, V. A.; Gavrikov, V. E.; Didyukov, A. I.; Dronov, A. P.; Orlov, V. K.; Piskunov, A. K.; Cherkasov, E. M. Sov. J. Quant. Electron. (Engl. Transl.); 4: No. 2, 250-251(Aug 1974).

Translated from Kvantovaya Elektron. (Moscow); 1: No. 2, 439-441(Feb 1974).

A gas dynamic laser was constructed, which used transitions in CO_2 molecules produced during combustion of solid nitro compounds. Constructional details with compositions of the combusted mixtures are given, together with performance data. (Electr. Electron. Abstr.)

16915 OUTPUT RADIATION OF AN ULTRAVIOLET NITROGEN LASER EXCITED TRANSVERSELY IN AN OPEN AIR CELL. Antonov, V. S.; Khyazev, I. N.; Movshev, V. G. Sov. J. Quant. Electron. (Engl. Transl.); 4: No. 2, 246-247(Aug 1974).

Translated from Kvantovaya Elektron. (Moscow); 1: No. 2, 433-435(Feb 1974).

The characteristics of a transversely excited open air cell emitting ultraviolet nitrogen superradiance are reported. A parallel plate Blumlein line, continuously charged, was used because of the simplicity of this system and its long life. At a charging voltage of 30 kV, the output power was some tens of kilowatts. (Electr. Electron. Abstr.)

16916 ACTIVE STABILIZATION OF A CARBON DIOXIDE LASER WITH A DIFFRACTION SELECTOR. Avtonomov, V. P.; Antropov, E. T.; Gorelik, A. V.; Silin-Bekchurin, I. A.; Sobolev, N. N. Sov. J. Quant. Electron. (Engl. Transl.); 4: No. 2, 263-264(Aug 1974).

Translated from Kvantovaya Elektron. (Moscow); 1: No. 2, 456-458(Feb 1974).

The stability of the putput in the form of one vibrational rotational laser line was improved by a thermally stable selector mirror unit with AFC, and the diffraction selection of transitions. The final amplitude instability was 0.5% in 14 minutes at an output power of ~1 W. (Electr. Electron. Abstr.)

16917 VARIATION OF THE DURATION OF PULSES EMITTED BY A MODE LOCKED CARBON DIOXIDE LASER. Berezovskii, V. V.; Bykovskii, Yu. A.; Lebedev, A. V.; Firsov, K. N. Sov. J. Quant. Electron. (Engl. Transl.); 4: No. 2, 256-257(Aug 1974).

Translated from Kovantovaya Elektron. (Moscow); 1: No. 2, 447-449(Feb 1974).

It is shown that the variation of the width of the CO_2 emission with increasing pressure can be used to control the duration of laser pulses under transverse mode-locking conditions, producing longer pulses than in the longitudinal case. Spontaneous transverse mode locking, at relatively high pressures are reported for the first time. Experimental details for demonstrating the effect, and for altering the number and spacing of the modes are described. (Electr. Electron. Abstr.)

16918 INFLUENCE OF THE SURFACE TREATMENT OF A CYLINDRICAL YTTRIUM-ALUMINUM GARNET CRYSTAL ON LASER ENERGY CHARACTERISTICS. Galoyan, K. V.; Khachatryan, K. M. Sov. J. Quant. Electron. (Engl. Transl.); 4: No. 2, 260-261(Aug 1974).

Translated from Kovantovaya Elektron. (Moscow); 1: No. 2, 453-454(Feb 1974).

The energy characteristics of YAG lasers were investigated as a function of the mechanical surface treatment of the active elements. The optimum surface finish was found to be obtained with abrasives of grain size 20 to 30 μ range. It was concluded that suppression of annular stray modes plays an important role in the laser performance. (Electr. Electron. Abstr.)

16919 BROADENING OF THE EMISSION SPECTRUM OF A SELF-MODE-LOCKED LASER. Kryukov, P. G.; Matveets, Yu. A.; Shatberashvili, O. B. Sov. J. Quant. Electron. (Engl. Trənsl.); 4: No. 2, 258-259(Aug 1974).

Translated from Kovantovaya Elektron. (Moscow); 1: No. 2, 450-452(Feb 1974).

Broadening of the emission of a self-mode-locked ruby laser to a width >6 cm^{-1} was achieved by introducing a plane parallel glass plate inside the resonator. This did not shorten the pulse duration, as measured by the two-photon luminescence method, a result attributed to the effect of the finite relaxation time of the non-linear absorber. (Electr. Electron. Abstr.)

16920 DEPENDENCE OF THE EVOLUTION OF HEAT IN NEODYMIUM DOPED YTTRIUM ALUMINUM GARNET ON THE OUTPUT. Shokin, A. A. Sov. J. Quant. Electron. (Engl. Transl.); 4: No. 2, 238-239(Aug 1974).

Translated from Kovantovaya Elektron. (Moscow); 1: No. 2, 423-425(Feb 1974).

It was discovered that the heat evolved from a laser element subjected to continuous pumping was less when coherent radiation was emitted. This effect is attributed to absorption by ions populating the metastable level and to non-radiative transitions. The change of rate of heat emission in low loss elements may be as much as 30% and could cause damage to laser elements. (Electr. Electron. Abstr.)

16921 THRESHOLD REDUCTION IN Pb/sub 1-x/Sn/sub x/Te LASER DIODES THROUGH THE USE OF DOUBLE HETEROJUNCTION GEOMETRIES. Tomasetta, L. R.; Fonstad, C. G. (Massachusetts Inst. of Tech., Cambridge). Appl. Phys. Lett.; No. 8, 440-442(15 Oct 1974).

A systematic study of the active region of Pb/sub 1-x/Sn/sub x/Te/PbTe laser diodes is reported, and its relation to the threshold for laser action. A considerable reduction in laser pulsed threshold over that for single heterojunction lasers is found for devices having 4 mu m active regions. Using devices made by liquid-phase epitaxy a further reduced threshold is achieved by using Tl-doped p-PbTe layers. (Electr. Electron. Abstr.)

16922 LASER CAVITY DENSITY CHANGES WITH KINETICS OF ENERGY RELEASE. Biblarz, O.; Fuhs, A. E. (Naval Postgraduate School, Monterey, CA). AIAA (Am. Inst. Aeronaut. Astronaut.) J.; 12: No. 8, 1083-1089(Aug 1974).

Inherent in any lasing process involving three or more energy levels is the release of heat. The heat is the inefficiency implied in the definition of laser quantum efficiency. In supersonic flow the heat release causes compression waves and a wake, thereby perturbing the gas density. Gas density variations within the laser cavity degrade the beam quality. A comprehensive analysis was made using an extension of the Tsien-Beilock linearized solution for heat addition. A computer program has been developed which incorporates multiple wall reflections, arbitrary beam cross section, and finite kinetics for the transition from the lower laser level to the ground state. Several examples are discussed. (Electr. Electron. Abstr.)

16923 QUANTUM MECHANICAL THEORY OF ORGANIC DYE LASER. Schaefer, R. B. Boston; Boston Univ. Graduate School (1975). 171p. University Microfilms Order No. 75-21,013.

Thesis (Ph. D.)

A fully quantum mechanical theory for the organic dye laser is given. Using the Born-Markoff master equation, density matrix equations of motion for the organic dye laser were obtained. These equations are solved for the radiation distribution in the steady state. An investigation of the result shows that the organic dye laser radiation distribution has features qualitatively different from that of other lasers. (TFD)

16924 PASSIVE Q-SWITCHING AND MODE-LOCKING OF A CO_2 LASER USING THE HALOGENATED BENZENE DERIVATIVES AS SATURABLE ABSORBERS. Caudle, G. F. La Cruces, NM; New Mexico State Univ. (1975). 167p. University Microfilms Order No. 75-28,921.

Thesis (Ph. D.).

Benzene and 11 of its halogenated derivatives were studied as possible Q-switching agents for the low pressure CO_2 laser. They represent a class of compounds which have one or more strong absorption bands in the 9 to 11 mu spectral region which tend to persist from one member of the class to another because of the structural similarity of the molecules. The molecules studied were: benzene, chlorobenzene, bromobenzene, o-dichlorobenzene, m-dichlorobenzene, m-difluorobenzene, m-fluorophenol, pentafluorobenzene, hexafluorobenzene, o-chlorotoluene, bromopentafluorobenzene and pentafluorotoluene. The first 9 of these mode-locked and Q-switched the laser for 123 laser line-saturable absorber combinations. The last three compounds did not Q-switch the laser on any line. The CO_2 laser used was a flowing-gas, large bore, low pressure laser with an active cavity 1.8 m long. It had a resonator length which could be varied between 6 m and 70 m and included a 150g/mm diffraction grating to tune the frequency of laser oscillation. The Q-switched and mode-locked pulses were investigated as a function of the saturable absorber pressure and the CO_2 laser operating parameters. Saturated absorption curves were measured for several of the saturable absorbers at various pressures. Both cw and pulsed radiation was used for each of the laser line-saturable absorber combinations measured. In all cases, the corresponding curves were very similar. The low level absorption coefficients $alpha_0$

and the saturation intensities I/sub s/ were determined respectively for benzene and bromobenzene for the laser lines P-18 and R-16 of the $00^01\text{-}02^00$ band. The saturated absorption curves were analyzed in terms of a 5 level rate equation model. By neglecting the excited state absorption, the maximum rotational relaxation time, tau/sub r/, and vibrational relaxation time, tau/sub v/, were estimated for benzene-P-18 and bromobenzene-R-16. (Diss. Abstr. Int., B)

16925 THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE MECHANISMS OF THE HYDROGEN-FLUORIDE PULSED CHEMICAL LASER. Hough, J. J. T. East Lansing, MI; Michigan State Univ. (1975). 135p. University Microfilms Order No. 75-27,274.

Thesis (Ph. D.).

Kinetic mechanisms in the pulsed HF chemical laser were examined by comparing predictions from improved theoretical models with experimental observations. Additional insight into these mechanisms is obtained by examining the predictions of the models in regions outside the domain of the present experiments. (TFD)

16926 COMPACT NEON–HELIUM LASER WITH AN INCREASED POWER RATING. Bazylenko, V. A.; Gryazev, A. A.; Krindach, D. P. (Moscow State Univ.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 921-923(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 206-208(1975).

An investigation of the lasing power of a Ne + He laser operating at $\lambda = 0.63\ \mu$, whose cavity contains three standard gas-discharge tubes taken from an LG-75 device is reported. The system of rotating mirrors situated at an angle of 45° with respect to the discharge axis allows the linear dimensions of the device to be reduced to 1 m for a lasing power > 60 mW for multimode operation. The effect of additional mirrors on the suppression of parasitic radiation at $\lambda = 3.39\ \mu$ in the laser is investigated. (auth)

16927 USE OF DIMETHYLSULFOXIDE AS THE SOLVENT OF DYES IN Q-MODULATORS IN LASER CAVITIES. Davydov, B. L.; Kozyarskii, D. Yu.; Fisher, P. S. (Inst. of Radio Engineering and Electronics, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 924-925(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 208-209(1975).

It is proposed that dimethylsulfoxide be used as the solvent of dyes in Q-modulators of laser cavities. Unlike other solvents that are used, dimethylsulfoxide is more volatile, considerably more toxic, and ensures good time stability of the modulator. The fabrication method and peculiarities of operation of modulators containing this solvent are described. (auth)

16928 RESONANCE PHENOMENA IN MULTIMODE LASERS WITH NONLINEAR ABSORPTION. Gnatovskii, A. V.; Danileiko, M. V.; Zubrilin, N. G.; Nedabnii, A. P.; Shpak, M. T. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 4, 690-691 (Apr 1975). (In Russian).

Very narrow power resonances were observed for the first time in He–Ne lasers on the wavelength of $3.39\ \mu$ with methane non-linearly absorbing cells in the region of the inverted Lamb shift. Its width was significantly less than homogeneous widths of methane absorption lines. These power resonances can be used to increase the resolving capacity of the non-linear laser spectroscopy of the first and second order. (tr-auth)

16929 INTENSITY OF RAYLEIGH SCATTERING AND NONRADIATIVE LOSSES FROM THE METASTABLE STATE OF Nd^{3+} IN LASER SILICATE GLASSES. Dianov, E. M.; Kut'enkov, A. A.; Manenkov, A. A.; Osiko, V. V.; Prokhorov, A. M.; Ritus, A. I.; Shcherbakov, I. A. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 2, 540-546(Aug 1975). (In Russian).

A difference in the luminescence characteristics of two silicate glasses was established on the basis of a study of the spectral-luminescent properties of laser glasses of complex composition activated with neodymium. The fine structure of Rayleigh scattering of these multi-component systems was investigated. For sake of comparison, the Rayleigh scattering spectra of a unicomponent glass (fused quartz) were also determined. A relation was found between the quantum yield for luminescence from the Nd^{3+} metastable state and intensity of the central component of the Rayleigh scattering spectrum. It is shown that in multicomponent systems scattering by microscopic inhomogeneities conditioned by the presence of several components may be weak and it is precisely in these systems that the quantum yield is close to unity. The quantum yield is low for multicomponent systems in which scattering by such microscopic inhomogeneities is considerable. Due to the micro-inhomogeneous structure of such systems the activator ions are nonuniformly distributed in the matrix and produce regions with high concentrations. The multipole interaction efficiency of active particles is appreciable in such regions, even if the activator content is small, and as a result the electron excitation is dissipated into thermal vibrations. (auth)

16930 TIME STRUCTURE OF GENERATION BY A MODE-LOCKED ARGON LASER. Egorov, O. K.; Krindach, D. P.; Landman, M. I.; Nazarov, B. I.; Salimov, V. M. (Moscow State Univ.). Zh. Eksp. Teor. Fiz.; 69: No. 2, 535-539(Aug 1975). (In Russian).

Results are reported of an experimental investigation of the time structure of the radiation emitted by a mode-locked argon laser. The radiation structure could be observed directly by employing a photoelectric recorder (limiting resolution 0.07 ns). The experiments show that just above the laser generation threshold the radiation pulses observed can satisfactorily be described by the well known expression for intensity derived under the assumption of vanishing initial phases of the oscillations generated. This condition is not always met if the generation threshold is considerably exceeded. A model is proposed which explains the features of the radiation structure observed. (auth)

16931 VIBRATIONAL RELAXATION AND LASERS OPERATING ON INTRAMOLECULAR VIBRATIONAL TRANSITIONS IN LIQUIDS AND MOLECULAR CRYSTALS. Gordiets, B. F.; Mamedov, Sh. S.; Shelepin, L. A. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 2, 467-476(Aug 1975). (In Russian).

Some features of vibrational relaxation in liquids and molecular crystals are considered. The role of collective interactions is discussed. Rates of vibrational processes are estimated. Possibilities of obtaining inverse population and amplifying radiation on basis of intramolecular vibrational transitions in liquids and molecular crystals are analyzed. It is shown that efficient lasers involving intense electron beams should be feasible. The possibilities are considered of employing a liquid medium in laser chemistry in which a chemical reaction is initiated at a low translational temperature by a powerful infrared beam. (auth)

16932 EFFECT OF THE FORM OF THE SPECTRAL LINES OF IMPURITY CENTERS ON THE LASER GENERATION SPECTRUM IN SPECTRALLY INHOMOGENEOUS CONDENSED MEDIA. Godenko, L. P. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 6, 1037-1040(Jun 1975). (In Russian).

The laser generation spectrum in spectrally inhomogeneous condensed media was theoretically studied with consideration of the Stark structure of lines of individual impurity centers. It was shown that the presence of these structures leads either to an increase of the number of generation channels (at large gaps between Stark components) or to a change of the quantitative ratio between frequencies and intensities in the generation spectrum. (tr-auth)

16933 LASER GENERATION IN SPECTRALLY INHOMOGENEOUS CONDENSED MEDIA DURING RESONANCE CROSS RELAXATION. Godenko, L. P.; Mashkevich, V. S. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 6, 1034-1036(Jun 1975). (In Russian).

The generation spectrum in the resonance mechanism of cross relaxation in a spectrally inhomogeneous condensed medium was studied theoretically. It was shown that if the rate of resonance cross relaxation is not too great, the spectrum has the characteristic "Y-connector" structure. A numerical calculation was made of the one- and two-line generation spectra. (tr-auth)

16934 NONSTATIONARY EXCITATION OF MULTIMODE GENERATION AT THE AUTOMODULATION OF LASER RADIATION. Allakhverdyan, R. G. (Inst. of Radiophysics and Electronics, Novosibirsk, USSR). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 10: No. 3, 233-235(1975). (In Russian)

A new mechanism for the generation of several axial-type oscillations in semi-conductor lasers near the generation threshold is considered. (auth)

16935 ENERGY MIGRATION AND THE PROCESS OF STIMULATED LIGHT EMISSION. Manuil'skii, A. D.; Odulov, S. G.; Soskin, M. S. pp 272-278 of Sovremennye Problemy Optikii Yadernoi Fiziki. Filippov, G. F. (ed.). Kiev; Izdatel'stvo Naukova Dumka (1974). (In Russian)

The results are presented of an experimental and theoretical investigation of radiationless energy transmission processes in the active media of lasers. The possibility is discussed of making use of laser techniques in the study of migration processes in generating and non-generating media. (Electr. Electron. Abstr.)

16936 LASER SOURCES. Forrester, P. A. AGARD Lecture Series No. 71. Neuilly-sur-Seine, France; AGARD (1974). 279p.

A general introduction to the most important of the wide range of lasers available is given. The basic physics common to all the

different types of laser is discussed in simple terms, and covers ideas such as stimulated and spontaneous emission, population inversion, resonator modes, etc, and describes methods of controlling the time variation of the output power by the techniques of Q-switching, cavity dumping and mode locking. Finally, the properties of some of the available devices, based upon optically-pumped solids, gaseous discharges and semiconductor diodes, are described. (Electr. Electron. Abstr.)

16937 RING He–Ne LASER WITH PHASE INTERACTION OF THE TRAVELING WAVE. Danileiko, M. V.; Zubrilyn, N. G.; Nedavnii, A. P.; Shpak, M. T. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 9, 1573-1575(Sep 1975). (In Russian)

A method for obtaining narrow and contrast reflecting power resonances in two-mode ring lasers was proposed and developed. The resonances arise as a result of phase interactions of the traveling waves during their symmetrical placement with respect to the center of the Doppler lines. The effect opens the possibility of creating a tunable spectrometer of superhigh resolution and a highly stable two-frequency optical frequency standard. (JSR)

16938 FLOW LASERS. Christiansen, W. H.; Russell, D. A.; Hertzberg, A. (Univ. of Washington, Seattle). Annu. Rev. Fluid Mech.; 7: 115-139(1975).

The fluid-mechanical aspects of high-power continuous-wave lasers is reviewed. The flow characteristics of these devices appear as classical fluid-mechanical phenomena recast in a complicated interactive environment. The fundamentals of high-power lasers are reviewed, followed by a discussion of the N_2CO_2 gas dynamic laser. Next, the HF/DF supersonic diffusion laser is described, and finally the CO electrical-discharge laser is discussed. (IAA)

16939 ANALYTIC AND NUMERICAL SOLUTIONS OF RATE EQUATIONS FOR MULTILEVEL CHEMICAL AND MOLECULAR LASERS IN QUASISTEADY APPROXIMATION. I. ANALYTIC TREATMENT. Igoshin, V.I.; Masterov, V.S. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 8, 886-891 (Aug 1975).

An analysis is made of kinetics of a multilevel laser utilizing vibration-rotational transitions in molecules. A solution is obtained of the rate equations for quasisteady emission. This solution is used in the derivation of an analytic expression describing the dependence of the output power of a laser on its principal parameters. (auth)

16940 SEMICONDUCTOR LASER UTILIZING INTRABAND TRANSITIONS BETWEEN MAGNETIC-FILM LEVELS. Aleksanyan, A.G.; Allakhverdyan, R.G.; Aleksanyan, Al.G. (Institute of Radiophysics and Electronics, Academy of Sciences of the Armenian SSR, Erevan). Sov. J. Quantum Electron. 5: No. 8, 891-894 (Aug 1975).

A thin-film semiconductor laser is analyzed theoretically. The gain is calculated for transitions between magnetic-film levels. The threshold conditions are deduced. (auth)

16941 MEASUREMENT OF THE LASER TRANSITION CROSS SECTION OF NEODYMIUM GLASSES. Dianov, E.M.; Karasik, A.Ya.; Kornienko, L.S.; Prokhorov, A.M.; Shcherbakov, I.A. (P.N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 8, 901-904 (Aug 1975).

Measurements were made of the Einstein coefficients of the spontaneous transitions from the $^4F_{3/2}$ metastable levels of Nd^{3+} to all the levels of the ^4I ground-state multiplet occurring in several silicate and phosphate glasses. The cross sections of the $^4F_{3/2}$–$^4I_{11/2}$ laser transition were determined. It was demonstrated that the spectroscopic methods suggested in the literature for the determination of these quantities could give rise to basic and uncontrollable errors. (auth)

16942 ACTION OF HIGH-POWER $\lambda = 530$ nm LASER RADIATION ON IODINE VAPOR. Ershov, L.S.; Zalesskii, V.Yu. Kokushkin, A.M. Sov. J. Quantum Electron. 5: No. 8, 904-909 (Aug 1975).

An investigation was made of the luminescence of iodine vapor excited by $\lambda = 530$ nm laser radiation of up to 10 MW/cm² intensity. The usual "fast" luminescence was accompanied by a weak and slowly decaying luminescence of recombination origin. The latter luminescence was evidence of the efficiency of the two-stage excitation of the molecules. The effective photon-absorption cross sections were estimated within the framework of a proposed model. These estimates made it possible to determine the best performance characteristics of a molecular iodine laser and the optimal pumping conditions. (auth)

16943 INVESTIGATION OF THE RELATIONSHIP BETWEEN STIMULATED EMISSION FROM CO MOLECULES AND KINETICS OF PHOTOINITIATED REACTIONS IN $C_3O_2+O_3$ MIXTURES. Pukhal'skaya, G.V.; Zhitneva, G.P.; Pshezhetskii, S.Ya.; Evseenko, A.L.; Zikeeva, N.V. (L. Ya. Karpov Physicochemical Scientific-Research Institute, Moscow). Sov. J. Quantum Electron. 5: No. 8, 922-926 (Aug 1975).

An investigation was made of the emission of stimulated radiation from CO^+ molecules formed as a result of the flash-photoinitiated reaction $C_3O_2+O \rightarrow 3CO^+$ in the presence of SF_6. A study was made of the dependences of the stimulated emission characteristics on the composition of the mixture and its pressure. The kinetics of the photoinitiated CO-forming reaction was investigated. The probable elementary processes occurring in parallel and in series with the main reaction were analyzed and their role in the kinetics of formation of excited CO^+ molecules was determined. The relationship between the stimulated emission and the kinetics of the chemical and relaxation processes was established. (auth)

16944 INVESTIGATION OF INFRARED STIMULATED EMISSION FROM A TRANSVERSELY EXCITED N_2 DISCHARGE LASER. Lisitsyn, V.N.; Sorokin, A.R.; Telegin, G.G. (Institute of Semiconductor Physics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk). Sov. J. Quantum Electron. 5: No. 8, 927-930 (Aug 1975).

Experimental investigations were made of the mechanisms of the population inversion and depletion of an infrared transition in N_2, of the role of field effects in the formation of infrared stimulated emission pulses, and of the dependence of spectral-time characteristics of infrared emission on the gas pressure. Stimulated infrared emission was observed at a pressure of 0.5 atm in pure nitrogen and at 1.5 atm on a N_2+He mixture. A comparison was made with the results obtained for a laser excited by a longitudinal discharge. An analysis was made of the possibility of constructing a continuously tunable infrared-emitting molecular nitrogen laser. (auth)

16945 INVESTIGATION OF THE CHARACTERISTICS OF A MAGNETICALLY TUNABLE PULSE SPIN-FLIP LASER. Ambartsumyan, R.V.; Dolzhikov, V.S.; Milin'chuk, Yu.I.; Mikhailov, E.L.; Chekalin, N.V. (Institute of Spectroscopy, Academy of Sciences of the USSR, Akademgorodok, Moscow Province). Sov. J. Quantum Electron. 5: No. 8, 938-941 (Aug 1975).

A magnetically tunable laser, emitting in the range 9.6–12.2 μ, was constructed. It was pumped with various CO_2 laser lines in the range 10.2–10.9 μ. Stimulated emission from this laser was obtained at the Stokes and anti-Stokes frequencies. A system composed of a gate amplifier and a signal store was used to record the absorption spectrum of ammonia in the 11 μ range. The measured width of the stimulated emission line, which governed the resolution of the laser spectrometer, was 0.2 cm^{-1}. Factors responsible for the broadening of this line were considered. (auth)

16946 HETEROGENEOUS LOSSES IN GASDYNAMIC LASERS. Shmelev, V.M.; Margolin, A.D. (Institute of Chemical Physics, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 8, 948-952 (Aug 1975).

A theoretical analysis is made of the main forms of vibrational energy losses in heterogeneous media used in gasdynamic lasers. Calculations show that the most important losses in a CO_2 gasdynamic laser are optical (absorption of light by particles); these losses increase with the gas pressure in the resonator and with the weight concentration of the particles. The most important losses in a CO gasdynamic laser are those associated with the deactivation of the excited molecules on the surfaces of condensated particles. (auth)

16947 INFLUENCE OF AMPLIFIED SPONTANEOUS RADIATION ON PARAMETERS OF A LONGITUDINALLY PUMPED LASER. Bogdankevich, O.V.; Darznek, S.A.; Zverev, M.M.; Ushakhin, V.A. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 8, 953-956 (Aug 1975).

Two-dimensionsal radiative transfer equations and population inversion rate equations are used to calculate various parameters of an electron-beam-pumped laser. Dependences of the threshold current density and output power on the transverse dimensions of the laser are obtained. The influence of amplified spontaneous radiation on the laser parameters is considered. (auth)

16948 ULTRAVIOLET NITROGEN LASER WITH AN OUTPUT POWER OF 0.5 W. Ishchenko, V.N.; Lisitsyn, V.N.; Razhev, A.M.; Starinskii, V.N. (Institute of Semiconductor Physics, Siberian Branch, Academy of Sciences of the USSR, Novosibirsk). Sov. J. Quantum Electron. 5: No. 8, 965-967 (Aug 1975).

An ultraviolet nitrogen laser with a double transverse discharge was provided with an efficient cooling of the gas by heat transfer to the walls. This made it possible to dispense with a rapid flow of the gas. The same cooling method should be suitable for laser systems with an average output power of ~1–10 W. An output exceeding 0.5 W was obtained experimentally at gas flow rates of <0.3 liter/sec. (auth)

16949 NEODYMIUM-GLASS LASER WITH ELECTROOPTIC EMISSION FREQUENCY CONTROL. Galich, G.A.; Grib, B.N.; Kondilenko, I.I.; Korotkov, P.A.; Kravchenko, V.I.; Pogorelyi, O.N. (Institute of Physics, Academy of Sciences of the Ukrainian SSR, Kiev). Sov. J. Quantum Electron. 5: No. 8, 982-983 (Aug 1975).

Continuous tuning of the emission wavelength of a neodymium-glass pulse laser was achieved by using a dispersive prism in combination with an electrooptic deflector inside the resonator. Variation of the control electric field within the range ±50 kV/cm provided a frequency tuning range of 12 nm. Possible methods for increasing the rate of tuning and the spectral brightness of the laser were considered. (auth)

16950 D_2O LASER FOR ABSOLUTE FREQUENCY MEASUREMENTS. Domnin, Yu.S.; Tatarenkov, V.M.; Shumyatskii, P.S. (All-Union Scientific-Research Institute of Physicotechnical and Radio Engineering Measurements, Mendeleevo). Sov. J. Quantum Electron. 5: No. 8, 991-993 (Aug 1975).

A description is given of a laser system emitting up to 40 mW at $\lambda=84$ μ. The results are reported of an investigation of the power characteristics and of beat signals between a D_2O laser, on the one hand, and HCN and H_2O lasers, on the other. (auth)

16951 HEATED-CATHODE PULSE CO_2 LASER PUMPED BY A GAS DISCHARGE AT ATMOSPHERIC PRESSURE. Karnyushin, V.N.; Malov, A.N.; Soloukhin, R.I. (Institute of Theoretical and Applied Mechanics, Siberian Branch, Academy of Sciences of the USSR). Sov. J. Quantum Electron. 5: No. 8, 994-995 (Aug 1975).

An investigation was made of the distribution of the gas density in a discharge gap of a continuous-flow CO_2 laser with a heated cathode. The influence of the cathode heating on the laser threshold was determined. It was established that the use of a heated cathode made it possible to increase the molecular gas content in the working mixture by improving the homogeneity of the discharge. (auth)

16952 SINGLE-FREQUENCY YAG:Nd^{3+} LASER STABILIZED BY AN ACTIVE STANDARD. Arzumanov, V.N.; Galaktionova, N.M.; Gershun, V.V.; Zaitsev, G.F.; Kruzhalov, S.V.; Mak, A.A.; Pakhomov, L.N.; Petrun'kin, V.Yu. Sov. J. Quantum Electron. 5: No. 8, 996-997 (Aug 1975).

An investigation was made of a YAG:Nd^{3+} laser with means for longitudinal and transverse mode selection and with frequency stabilization by an external standard. The longitudinal modes were selected by a T-shaped resonator and an inclined Fabry–Perot interferometer. The external standard was the resonator of an He–Ne laser stabilized at $\lambda=1.15$ μ using the Lamb dip. The frequency stability achieved in this way was 10^8 for an output power of 300 mW. (auth)

16953 LASER UTILIZING CU I TRANSITIONS IN COPPER HALIDE VAPORS. Akirtava, O.S.; Dzhikiya, V.L.; Oleinik, Yu.M. Sov. J. Quantum Electron. 5: No. 8, 1001-1002 (Aug 1975).

Stimulated emission at a high pulse repetition frequency was obtained as a result of self-terminating transitions in the copper atom in CuCl and CuBr vapors. The repetition frequency was equal to the excitation pulse frequency (16.5 kHz). The efficiency of the CuBr laser was ~1%. The average output power in the form of the $\lambda=510.5$ and 578.2 nm lines was 12 W. The stimulated emission was observed in 12, 18, and 30 mm diameter quartz discharge tubes. (auth)

16954 COPPER VAPOR LASER OPERATING AT A HIGH PULSE REPETITION FREQUENCY. Subotinov, N.V.; Kalchev, S.D.; Telbizov, P.K. (Institute of Solid State Physics, Academy of Sciences of the Bulgarian People's Republic, Sofia). Sov. J. Quantum Electron. 5: No. 8, 1003-1004 (Aug 1975).

An investigation was made of the optimal conditions for the operation of a copper vapor laser emitting at 510.6 and 578.2 nm. Stimulated emission was obtained as a result of a discharge in an Ne–CuI mixture. A simple power supply system ensured a stimulated emission pulse repetition frequency of 30 kHz. (auth)

16955 SPATIAL, TEMPORAL, AND SPECTRAL CHARACTERISTICS OF RADIATION EMITTED BY A Q-SWITCHED YAG:Nd LASER. Dmitriev, V.G.; Shalaev, E.A.; Shvom, E.M. Sov. J. Quantum Electron. 5: No. 8, 1004-1006 (Aug 1975).

An investigation was made of the fine structure of the intensity and spectrum of giant pulses emitted by a YAG:Nd laser. These ultrashort pulses were recorded using an image-converter streak camera with a resolution of at least 25 psec. In general, a "domain" spatial-temporal structure was observed in the radiation and it corresponded to a partial locking of the longitudinal and transverse modes. Special cases of the transverse or longitudinal mode selection were investigated. A fine structure of this kind should be allowed for in estimating the optical strength of the resonator elements and in nonlinear conversion processes. (auth)

16956 SINGLE-FREQUENCY TUNABLE TRAVELING-WAVE RUBY LASER WITH ACTIVE Q-SWITCHING. Bakhorin, V.A.; Malyshev, V.I.; Markin, A.S.; Sychev, A.A. (Moscow Institute of Radio Engineering, Electronics, and Automation). JETP Lett. 22: No. 2, 40-41 (20 July 1975).

A stable single-frequency regime is obtained in a traveling-wave ruby laser with active Q-switching, using a single selecting plate inside the resonator. Frequency tuning in a range 0.6 cm^{-1} is accomplished by varying the inclination angle of the selector. (auth)

16957 STABILIZATION OF A RUBY LASER USING AN He-Ne LASER AS A FREQUENCY REFERENCE. Bondarenko, A.N.; Kruglov, S.V. JETP Lett. 22: No. 2, 46-47 (20 July 1975).

A method is proposed for active stabilization of the ruby-laser frequency. The gist of the method is that the Q of the laser resonator is chosen to be low enough to make the lasing frequency and its stability governed by a high-Q Fabry–Perot interferometer placed inside the resonator at a small angle to its axis. The distance between the interferometer mirror is rigidly stabilized with the aid of an electron-optical negative-feedback system that consists of a stabilized He-Ne laser, a photoreceiver, and a differential amplifier. The absolute instability of the frequency amounts to 3×10^{-3} cm^{-1}. (auth)

16958 INTERMOLECULAR INTERACTION AND INDUCED-EMISSION SPECTRA OF LIQUID ACTIVATED SYSTEMS. 5: QUANTITATIVE STUDY OF THE INFLUENCE OF THE MIXED SOLVENT COMPOSITION ON THE LASING THRESHOLD OF SUBSTITUTED PHTHALIMIDES. Studenov, V.I.; Piterskaya, I.V.; Bakhshiev, N.G. Opt. Spectrosc. (USSR) 39: No. 2, 175-178 (Aug 1975).

The spectral luminescence and lasing (lasing frequency, lasing threshold) parameters of 3- and 4-amino-N-methyl phthalimide in mixed nonpolar or weakly polar and polar solvents were compared with the values characterizing the intermolecular relaxation processes in the solution. It was demonstrated that, in accordance with concepts developed, a clear dependence of the threshold on the magnitude of the energy gap between the ground equilibrium and Franck–Condon electronic states of the activator molecule in the solution is observed: the greater the energy gap, the lower the lasing threshold, and vice versa. A preliminary evaluation of some experimental data that testify to the substantial effect of the statistical intermolecular processes on the lasing parameters of multicomponent solutions is offered. (auth)

16959 SOME PECULIARITIES IN THE POLARIZATION CHARACTERISTICS OF LASER EMISSION IN A MAGNETIC FIELD. Smirnov, V.S.; Tumaikin, A.M. Opt. Spectrosc. (USSR) 39: No. 2, 198-201 (Aug 1975).

The problem of the polarization characteristics of the emission of gas lasers placed in a weak longitudinal magnetic field is discussed. It is shown that the variation of different parameters (the magnetic field and the resonator frequency) may lead to jumps in the degree of circular polarization. It is illustrated that the location of the point of the jump depends on the previous history and has a hysteresis character; that is, it is determined by the type of the initial circular polarization and the direction of the scanning frequency of the resonator or of the magnetic field. A physical interpretation of the origin of these jumps is given, and the potential applications of the effect discovered are discussed. (auth)

16960 INFLUENCE OF THE OPTICAL INHOMOGENEITY OF THE ACTIVE MEDIUM OF A GAS LASER ON ITS EMISSION FREQUENCY. Mardanov, R.F. (Aviation Institute, Kazan). Sov. J. Quantum Electron. 5: No. 9, 1021-1024 (Sept 1975).

Formulas are obtained for the spatial distribution of the refractive index in gaseous active media excited by a glow discharge. These formulas are based on the results of several experimental investigations. Resonance relationships for a linear laser with internal mirrors are derived in the paraxial approximation using the formalism of the ray (line) transmission matrix. Conditions are obtained for the minimum influence of the optical inhomogeneity of the active medium on the emission frequency. (auth)

16961 SPECTRAL KINETICS OF STIMULATED EMISSION FROM SOLUTIONS AND RELAXATION PROCESSES IN DYE MOLECULES. Shilov, V.B.; Neporent, B.S.; Lukomskii, G.V.; Spiro, A.G.; Antonevich, G.N. Sov. J. Quantum Electron. 5: No. 9, 1024-1028 (Sept 1975).

A quantitative investigation was made of the relaxational shift of the spectra during the evolution of a stimulated emission pulse in a solution of rhodamine 6G in ethanol excited by a frequency-tunable Q-switched laser. A linear relationship was established between the relaxational shift and the power of the stimulated radiation field in the resonator. The rate of shift was found to depend on the pump ν_a and stimulated emission ν_y frequencies. The probabilities of the vibrational (transverse) relaxation were found to be within the range $W^{vv}\simeq10^{10}$–10^{11} sec^{-1}, depending on the values of ν_a and ν_y. The relaxation processes under discussion were found to be controlled by the properties of the vibrational states of the molecules and the dominant effect was the relaxation of the totally symmetric high-frequency vibrations. An analysis was made of the possible influence of the solvent on the intramolecular relaxation processes. (auth)

16962 NARROW RESONANCES OF POLARIZATION CHARACTERISTICS OF GAS LASERS IN MAGNETIC FIELDS AND THEIR USE IN HIGH-RESOLUTION SPECTROSCOPY.

Voitovich, A.P.; Dubovik, M.V.; Shkadarevich, A.P. (Institute of Physics, Academy of Sciences of the Belorussian SSR, Minsk). Sov. J. Quantum Electron. 5: No. 9, 1034-1037 (Sept 1975).

An investigation was made of the competition between two frequencies of radiation with orthogonal circular polarization. Each of these frequencies was generated as one of the σ components in the gain band. This competition produced narrow (much narrower than the homogeneous width of the gain band) resonances of the output radiation power. Isotopic shifts of the $\lambda=1.161$ and 1.198 μ lines of Ne^{20} and Ne^{22} were determined. (auth)

16963 COMPENSATION OF BIREFRINGENCE INDUCED IN LASER SYSTEMS BY PASSIVE ANISOTROPIC ELEMENTS. Evdokimova, V.G.; Mak, A.A.; Soms, L.N.; Shafarostov, A.I. Sov. J. Quantum Electron. 5: No. 9, 1040-1044 (Sept 1975).

An analysis is made of two systems for compensating birefringence induced in an active element when thermal stresses in the element have a longitudinal symmetry plane. Simple passive anisotropic elements are used in both systems. The Jones matrix method is used to demonstrate that these systems, together with thermally stressed active elements, are equivalent to a half-wave phase plate. An estimate is obtained of the influence of a thermal lens formed in an active element on the birefringence compensation process. Experiments proving the feasibility of the systems are reported. A periodic double-pass amplifier based on these systems is proposed. (auth)

16964 INTERNAL REFLECTING SURFACES IN UNSTABLE RESONATORS. Anan'ev, Yu.A.; Grishmanova, N.I.; Petrova, I.M.; Sventsitskaya, N.A. Sov. J. Quantum Electron. 5: No. 9, 1060-1062 (Sept 1975).

An explanation is given of a strong increase in the divergence of laser radiation resulting from the presence of surfaces separating different media in an unstable resonator. The reflection from these surfaces forms "converging" waves. An analysis is also made of the role played by the scattering of light due to other factors. (auth)

16965 GALLIUM ARSENIDE ELECTRON-BEAM-PUMPED LASER WITH A DISTRIBUTED FEEDBACK. Bykovskii, Yu.A.; Goncharov, I.G.; Dedushenko, K.B.; Kozhevnikov, A.V.; Luk'yanov, V.N.; Uzkii, A.F.; Shveikin, V.I.; Shelkov, N.V.; Yakubovich, S.D. Sov. J. Quantum Electron. 5: No. 9, 1063-1066 (Sept 1975).

An experimental investigation was made of the threshold and spectral characteristics of an electron-beam-pumped GaAs laser with a distributed feedback. A comparison of the experimental results with a theoretical distributed-feedback model of a one-dimensional structure yielded the parameters of the investigated laser. The distribution of the radiation intensity was nonuniform over the length of the active medium, as predicted by the theoretical model. (auth)

16966 DISTRIBUTION OF NEODYMIUM LASER ENERGY BETWEEN MODES. Malyshev, V.I.; Masalov, A.V.; Milanich, A.I. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 9, 1066-1069 (Sept 1975).

An experimental investigation was made of the spectral statistics of the radiation emitted by a Q-switched neodymium laser. The emission spectrum was recorded with a resolution equal to the model spacing. It was found that the density of the probability of the appearance of an axial mode of a given intensity was described by an exponential function and the mode intensities were not correlated with one another. The results were in good agreement with the hypothesis of the fluctuating nature of laser radiation. (auth)

16967 SELF-DAMAGE IN ELECTRON-BEAM-PUMPED GALLIUM ARSENIDE LASERS. Antoshin, M.K.; Krasavina, E.M.; Kryukova, I.V.; Sluev, V.I.; Spivak, G.V. (All-Union Scientific Research Institute of Optophysical Measurements, Moscow). Sov. J. Quantum Electron. 5: No. 9, 1069-1074 (Sept 1975).

An investigation was made of catastrophic degradation of electron-beam-pumped gallium arsenide lasers operating at temperatures of 80 and 300°K. The critical radiation density in the semiconductor resonator resulting in its damage ranged from 2 to 15 MW/cm², depending on the temperature, optical homogeneity, and quality of the surface treatment of the crystal. An analysis was made of the mechanisms of the fracture of gallium arsenide crystals under the action of their own laser radiation. (auth)

16968 EXPERIMENTAL INVESTIGATION OF THE KINETICS OF FORMATION OF EXCITED Xe_2 MOLECULES IN A COMPRESSED-XENON LASER. Baranov, M.D.; Burdin, S.G.; Danilychev, V.A.; Kerimov, O.M. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 9, 1084-1087 (Sept 1975).

The temperature dependences of the rate constants of the formation of excited xenon dimers and of the excitation quenching were determined. The experimental values of the rate constant of the three-particle formation of excited dimers were found to be described satisfactorily by the analytic dependence $\ln(\beta/\beta_0)=0.39\times10^3T^{-1}+0.66$ (β_0 10^{-32} cm⁶/sec; T was measured in °K). When the gas temperature was lowered from 295 to 149°K, the rate constant of the quenching of excited xenon atoms fell from $\alpha=(1.1\pm0.2)\times10^{-13}$ cm³/sec to $\alpha\sim10^{-14}$ cm³/sec. The measured radiative lifetime of the $^{3,1}\Sigma^+_u$ state of the xenon molecule was found to be $\tau=30\pm10$ nsec. (auth)

16969 FINE STRUCTURE IN THE STIMULATED EMISSION SPECTRA OF ORGANIC DYE SOLUTIONS. Gruzinskii, V.V.; Paltarak, N.M. (Institute of Physics, Academy of Sciences of the Belorussian SSR, Minsk). Sov. J. Quantum Electron. 5: No. 9, 1087-1089 (Sept 1975).

A study was made of the stimulated emission from liquid and solid solutions of 2, 5-diphenyloxazole. These solutions were characterized by electronic spectra with a vibrational structure and they were excited by the second harmonic of ruby laser radiation which not only produced coherent radiation but also caused resonant stimulated Raman scattering (RSRS) of light in the ultraviolet part of the spectrum at 160–293°K. Two RSRS lines were observed at 1543 and 1606 cm⁻¹. The line intensities increased with rising temperature. The line positions were independent of the nature of the solvent, concentration of the solution, temperature, and Q factor of the resonator; only the relative intensities of the lines were affected by these factors. (auth)

16970 INFLUENCE OF DISCHARGE-CURRENT FLUCTUATIONS ON THE OPERATION OF A HELIUM-NEON LASER UTILIZING COUPLED $3s_2$-$2p_4$ AND $3s_2$-$3p_4$ TRANSITIONS IN NEON. Borisova, M.S.; Mazan'ko, I.P.; Petrashko, G.A. Sov. J. Quantum Electron. 5: No. 9, 1090-1092 (Sept 1975).

A calculation was made of the intensity of stimulated emission from a helium-neon laser emitting simultaneously due to two coupled $3s_2$-$2p_4$ ($\lambda=0.63$ μ) and $3s_2$-$3p_4$ ($\lambda_i=3.39$ μ) transitions. It was found that, under certain conditions, the emission of $\lambda_i=3.39$ μ could alter considerably (in particular, could reduce) the sensitivity of the intensity of visible radiation to discharge-current fluctuations. The theoretical conclusions were confirmed experimentally at low frequenices of the fluctuations of the current density. (auth)

16971 GENERATION OF ULTRASHORT PULSES IN A TWO-COMPONENT LASER UNDER INDUCED MODE-LOCKING CONDITIONS. Krivoshchekov, G.V.; Nikulin, N.G.; Smirnov, V.A. (Institute of Semiconductor Physics, Siberian Branch, Academy of Sciences of the USSR, Novosibirisk). Sov. J. Quantum Electron. 5: No. 9, 1096-1099 (Sept 1975).

A method was developed for generating ultrashort pulses of duration close to the reciprocal of the width of the gain profile. This method was based on mode locking induced by active modulation of the resonator losses at the intermodal frequency. This locking occurred in a laser with a two-component (amplifying-absorbing) medium with a homogeneously broadened line. A theoretical analysis was followed by an experimental investigation of the formation of ultrashort pulses in a traveling-wave laser of this type. The theoretical and experimental results were found to be in good qualitative agreement. The experiments demonstrated that stable ultrashort pulses of $\sim5\times10^{-12}$ sec duration could be generated. (auth)

16972 INVESTIGATION OF A PERIODICALLY OPERATED DISK ACTIVE ELEMENT. Buchenkov, V.A.; Mak, A.A.; Malinin, B.G.; Soms, L.N.; Stepanov, A.I. Sov. J. Quantum Electron. 5: No. 9, 1106-1108 (Sept 1975).

An investigation was made of the influence of the inactive losses and resonator deformation on the energy characteristics of the output radiation of a neodymium glass laser. Stresses in a disk active element, causing considerable depolarization of the outtput radiation under periodic operation conditions, were studied. (auth)

16973 ENHANCEMENT OF THE EFFICIENCY OF THE N_2 LASER. Bychkov, Yu.I.; Losev, V.F.; Savin, V.V.; Tarasenko, V.F. (Institute of Atmospheric Optics, Siberian Division, Academy of Sciences of the USSR, Tomsk). Sov. J. Quantum Electron. 5: No. 9, 1111-1115 (Sept 1975).

A report is given of a theoretical and experimental investigation of the characteristic features of excitation of the nitrogen laser and methods are suggested for increasing its efficiency. The output characteristics of a laser are reported as dependences on the parameters of the discharge circuit and gas pressure. (auth)

16974 THEORY OF AMPLIFICATION AND GENERATION OF LIGHT IN ACTIVATED SOLUTIONS IN THE PRESENCE OF INTERMOLECULAR RELAXATION. Bakhshiev, N.G.; Girin, O.P. Sov. J. Quantum Electron. 5: No. 9, 1118-1119 (Sept 1975).

An analysis is made of the intermolecular relaxation processes in activated solutions, which transform a two-level system of vibronic states of the activator molecules to a four-level system. It is shown that this alters considerably the main relationships in the theory of amplification and generation of light in activated solutions. More rigorous relationships obtained in the new model predict changes (in the course of pumping) not only of the intensity but generally also of the position and form of the absorption and luminescence spectra of such solutions,

which should help in the interpretation of the known and new stimulated emission phenomena. (auth)

16975 THIN-FILM RHODAMINE 6G WAVEGUIDE LASER WITH A CORRUGATED SUBSTRATE. Deryugin, L.N.; Ovcharenko, O.I.; Sotin, V.E.; Chekhlova, T.K. (Patrice Lumumba Friendship of Nations University, Moscow). Sov. J. Quantum Electron. 5: No. 9, 1129-1130 (Sept 1975).

An experimental investigation was made of a thin-film laser with a distributed feedback ensured by a periodic modulation of the waveguide layer thickness. Stimulated emission was observed for samples with modulation periods of 0.2 μ (first Bragg diffraction order), 0.6 μ (third order), and 1 μ (fifth order). An estimate was obtained of the threshold pump power absorbed in a specific thin-film laser. (auth)

16976 GASDYNAMIC WATER-VAPOR-CONDENSATION LASER. Konyukhov, V.K.; Prokhorov, A.M.; Tikhonov, V.I.; Faizulaev, V.N. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 9, 1131-1132 (Sept 1975).

A theoretical description is given of the principle of operation of a new laser which transforms the energy of the vapor–liquid phase transition into the energy of coherent electromagnetic radiation. The active medium represents unstable strongly excited condensation products formed during the flow of a vapor through a supersonic nozzle. It is shown that a population inversion of intermolecular vibrational levels is possible in water dimer molecules. (auth)

16977 STIMULATED EMISSION FROM A TRANSVERSE DISCHARGE IN COPPER VAPOR. Aleksandrov, I.S.; Babeiko, Yu.A.; Babaev, A.A.; Buzhinskii, O.I.; Vasil'ev, L.A.; Efimov, A.V.; Krysanov, S.I.; Nikolaev, G.N.; Slivitskii, A.A.; Sokolov, A.V.; Tatarintsev, L.V.; Tereshchenkov, V.S. Sov. J. Quantum Electron. 5: No. 9, 1132-1133 (Sept 1975).

An experimental laser system was built in which a mixture of copper vap r and neon pumped by transverse pulse discharges. The system included a laser cell and pulse generator producing pulses of 100 nsec duration and 1 kHz repetition frequency. An average output power at λ=510.6 nm was 100 mW and the specific energy output was 8×10^{-6} J/cm³. (auth)

16978 TUNING OF A HIGH-POWER PULSE CO_2 LASER TO 9-μ REGION. Karlov, N.V.; Karpov, N.A.; Kovalev, I.O.; Kuz'min, G.P.; Prokhorov, A.M. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 9, 1133-1135 (Sept 1975).

A method was developed for tuning a pulse CO_2 laser to the 9-μ region. This was done using resonant absorbers placed inside the laser resonator. The pressure in a cell with an absorbing gas was varied from 5 mm Hg to 1 atm. The output in the 9-μ region was comparable with that at λ=10.6 μ. (auth)

16979 PbSnTe-PbTe HETEROJUNCTION LASER EMITTING AT λ = 10 μ. Kurbatov, L.N.; Britov, A.D.; Karavaev, S.M.; Gorina, Yu.I.; Kalyuzhnaya, G.A.; Starik, P.M. Sov. J. Quantum Electron. 5: No. 9, 1137-1139 (Sept 1975).

An *n*-PbTe-*p*-$Pb_{1-x}Sn_xTe$ heterojunction laser was fabricated by epitaxial growth of PbTe from the vapor phase on a $Pb_{0.83}Sn_{0.17}Te$ substrate. Stimulated emission of the TE modes was obtained at wavelengths of 10.2 μ at 77°K and 12.2 μ at 33°K. Continuous stimulated emission was obtained at liquid helium temperatures. (auth)

16980 ATTAINMENT OF A HOMOGENEOUS DISCHARGE IN A LARGE-VOLUME PULSE CO_2 LASER. Baranov, V.Yu.; Borisov, V.M.; Satov, Yu.A.; Stepanov, Yu.Yu. Sov. J. Quantum Electron. 5: No. 9, 1139-1140 (Sept 1975).

A distributed electrical discharge was established in a 20×20×30 cm volume supplied with an energy of the order of 3.2 J. It was found to be possible to use the "plasma plateau" as the main electrode. This avoided the need for a specially shaped semitransparent electrode and also increased the efficiency of preionization of the discharge gap by ultraviolet radiation; in this way a greater energy could be supplied to the plasma. Moreover, the construction of the electrode system was simplified and the dimensions of the discharge chamber were greatly reduced. The use of the proposed electrode configuration should make it possible to build simple large-aperture amplifying stages with a considerable energy output per unit volume. (auth)

16981 INVESTIGATION OF THE ENERGY CHARACTERISTICS OF A CHEMICAL CO_2 LASER UTILIZING A $O_3+D_2+CO_2$ MIXTURE. Bashkin, A.S.; Oraevskii, A.N.; Tomashov, V.N.; Yuryshev, N.N. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 9, 1144-1145 (Sept 1975).

The operating parameters of a chemical CO_2 laser were optimized in order to achieve maximum output energy. The results obtained under pulse operation conditions were used in an estimate of possible parameters of a chemical cw CO_2 laser utilizing a $O_3+D_2+CO_2+He$ mixture. (auth)

16982 LASER GAIN DUE TO $5s[1/2]^0_1$-$4p[3/2]_2$ TRANSITION IN NEON AT λ = 3.39 μ. Popov, A.I.; Protsenko, E.D. (Moscow Engineering-Physics Institute). Sov. J. Quantum Electron. 5: No. 9, 1153-1154 (Sept 1975).

An investigation was made of the dependence of the gain of helium-neon medium due to the $5s[1/2]^0_1$-$4p[3/2]_2$ laser transition in Ne on the pressure in the gas mixture and on the discharge current in tubes of different internal diameters. Formulas were obtained for the calculation of the discharge parameters necessary for the attainment of maximum gain. (auth)

16983 LASER RESEARCH. Leuchtag, H.R. Phys. Today 28: No. 11, 55-63 (Nov 1975).

Exchange visits have given us a good view of Soviet work on laser fusion, nonlinear optics, laser spectroscopy, isotope separation and the development of new lasers and enhanced the prospects for further cooperation. (auth)

16984 EFFECTIVE GLOW DISCHARGE EXCITATION OF NITROGEN LASERS AT GAS PRESSURES RANGING FROM 0 TO 5 BAR. Hasson, V.; von Bergmann, H.M.; Preussler, D. (Optical Sciences Division, National Physical Research Laboratory of the South African Council for Scientific and Industrial Research, Pretoria 0001, South Africa). Appl. Phys. Lett. 28: No. 1, 17-18 (1 Jan 1976).

This paper applies a novel stabilization technique to the effective glow discharge excitation of uv nitrogen lasers at gas pressures ranging from 0 to 5 bar. The plasma is produced between uniform field electrodes and can be stabilized at electrode separations of down to 1 mm. The stabilization is relatively insensitive to the electrode geometry and surface finish. Megawatt pulses were obtained from a 25-cm atmospheric-pressure device energized by a simple flat-plate Blumlein circuit. (auth)

16985 CONTINUOUS OPERATION OF 1.0-μm-WAVELENGTH $GaAs_{1-x}Sb_x/Al_yGa_{1-y}As_{1-x}Sb_x$ DOUBLE-HETEROSTRUCTURE INJECTION LASERS AT ROOM TEMPERATURE. Nahory, R.E.; Pollack, M.A.; Beebe, E.D.; DeWinter, J.C. (Bell Telephone Laboratories, Holmdel, New Jersey 07733); Dixon, R.W. Appl. Phys. Lett. 28: No. 1, 19-21 (1 Jan 1976).

Double-heterostructure $GaAs_{1-x}Sb_x/Al_yGa_{1-y}As_{1-x}Sb_x$ injection lasers have been operated continuously at room temperature for the first time. Emission was near 1.0 μm. The lowest threshold current density observed was 2.1 kA cm^{-2} dc. (auth)

16986 HIGH-EFFICIENCY KrF EXCIMER LASER. Bhaumik, M.L.; Bradford, R.S. Jr.; Ault, E.R. (Northrop Research and Technology Center, Hawthorne, California 90250). Appl. Phys. Lett. 28: No. 1, 23-24 (1 Jan 1976).

Efficient high-power laser emission has been observed at 249 nm from a KrF excimer laser obtained by an electron-beam-pumped mixture of Ar, Kr, and NF_3 (1300:130:1) at a total pressure of 2.25 atm. An energy of 1.5 J was extracted in a 125-nsec (FWHM) pulse from a 100-cm^3 volume, using a coaxial electron-beam laser. Laser efficiency was estimated to be nearly 15% based on energy deposition in the gas. Over-all electrical efficiency was ~1%. (auth)

16987 EXPERIMENTS ON 558-nm ARGON OXIDE LASER SYSTEM. Hughes, W.M. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545); Olson, N.T.; Hunter, R. Appl. Phys. Lett. 28: No. 2, 81-83 (15 Jan 1976).

Vacuum ultraviolet (VUV) photolysis of N_2O immersed in high-pressure Ar has been used to produce $O(^1S_0)$ at high density. A two-chamber apparatus was used to prevent the effects of electron and ion collision in the experimental volume, thereby providing a much clearer kinetic situation. The gain profile and stimulated emission cross section near 558 nm and the upper-state lifetime were determined for ArO. (auth)

16988 uv TEA LASER WITH 760-Torr N_2. Bergmann, E.E. (Department of Physics, Lehigh University, Bethlehem, Pennsylvania 18015). Appl. Phys. Lett. 28: No. 2, 84-85 (15 Jan 1976).

A simple reliable transversely excited atmospheric (TEA) laser operating with moderate repetition rates at 337 nm using commercial-grade N_2 at 1 atm is described. Preliminary results for a range of operating voltages and channel spacings are presented. The laser's pulse width is about 1 nsec. Best electrical efficiency to date is 0.039% at 8.8 kV. At 21 kV, 355 μJ/pulse is obtained. Above 16.7 kV, the unfocused output will pump a dye solution to superradiance at a distance of 1.5 m. For supply voltages less than 10 kV, a novel configuration for preionization is described. (auth)

16989 XENON FLUORIDE LASER EXCITATION BY TRANSVERSE ELECTRIC DISCHARGE. Burnham, R. (Science Applications Incorporated, Alexandria, Virginia 22202); Harris, N.W.; Djeu, N. Appl. Phys. Lett. 28: No. 2, 86-87 (15 Jan 1976).

Stimulated emission has been produced in mixtures of He, NF_3, and Xe at total pressures between 300 and 1000 Torr. Laser emission was on lines at 3511 and 3531 Å which have been associated with the excited XeF molecule. Excitation of the gas mixture was by a transverse electric discharge which produced pulses with peak currents of approximately 10^4 A and rise times of 20 ns. A maximum laser energy of 7 mJ was obtained from a gas mixture with a ratio of He:Xe:NF_3 of 98.0:1.5:0.5 at a total pressure of 300 Torr. (auth)

16990 OBSERVATION OF FIRST STOKES, SECOND STOKES, AND ANTI-STOKES RADIATION FROM A MERCURY CADMIUM TELLURIDE SPIN-FLIP RAMAN LASER. Kruse, P.W. (Honeywell Corporate Research Center, Bloomington, Minnesota 55420). Appl. Phys. Lett. 28: No. 2, 90-92 (15 Jan 1976).

Single-crystal $Hg_{0.77}Cd_{0.23}Te$ has been employed in a spin-flip Raman laser to generate first Stokes and anti-Stokes radiation when pumped at 10.60 μm, and first Stokes, second Stokes, and anti-Stokes radiation when pumped at 10.28 μm. (auth)

16991 NEAR INFRARED CW LASER OSCILLATION IN Cu II. Csillag, L.; Janossy, M.; Rozsa, K.; Salamon, T. (Central Research Inst. of Physics, Budapest). Phys. Lett., 50A: No. 1, 13-14(4 Nov 1974).

CW laser oscillation was observed at the 7808 Å transition of Cu II in He-Ne-Cu, He-Ar-Cu, and He-Kr-Cu hollow cathode discharges. The role of the noble gas mixture in obtaining laser action is discussed. (Electr. Electron. Abstr.)

16992 MIXED FLOW GAS DYNAMIC LASER. Charpenel, M.; Taran, J. P.; Borghi, R. (Office National d'Etudes et de Recherches Aerospatiales, Chatillon, France). Rech. Aerosp.; No. 4, 189-197(1974). (In French)

Research on expansion lasers with thermal excitation led to the concept of a type of gas dynamic laser that is original as regards the mixing means of the gases. This mixing is ensured, after heating and excitation of the nitrogen during expansion, around the centerline of the nozzle throat. With this solution, the energy losses due to incomplete vibration freezing in the nozzle are minimized, and this for high stagnation temperatures permitting the storage of a higher proportion of energy on the nitrogen molecule vibration. First results obtained at 2800°K are promising: optical gains approaching 4% cm^{-1}, 1.6% efficiency, to be compared to premixed thermal excitation lasers for which the optimum temperature does not exceed 1800°K. They confirm calculated results, the parametric study predicting an increased efficiency up to 3500°K. (Electr. Electron. Abstr.)

16993 MOLECULAR ULTRAVIOLET LASERS. I. Electronic Pumping of Low Pressure Gases. Girardeau-Montaut, J. P. (Univ., Clermont, France). Onde Electr.; 54: No. 9, 456-562(Nov 1974). (In French)

Different pulsed electronic pumping techniques which are used with molecular gases to produce new laser lines of ultraviolet spectrum are presented. Their characteristics are analyzed and compared relatively to spectral data of observed emission lines. (Electr. Electron. Abstr.)

16994 STUDY OF THE DEGRADATION OF GALLIUM ARSENIDE LASER DIODES IN A PHOTOEMISSION ELECTRON MICROSCOPE. Kurbatov, L. N.; Krupukhin, V. V.; Kagan, N. B.; Rozenfel'd, L. B.; Bibik, V. F. Izv. Akad. Nauk SSSR, Ser. Fiz.; 13: No. 11, 2275-2278(Nov 1974). (In Russian)

A study was made of the process of the degradation of gallium arsenide laser diodes. In connection with the fact that the infrared radiation density at its exit from the injection laser crystal is very high and reaches 10^6 to 10^7 w-cm^{-2}, the theory is stated of the possibility of electron emission from the exit domains of the laser radiation from the crystal. A photoemission electron microscope was used for detection and investigation of this emission. The electron emission from the active region was detected at the diode degradation threshold, which confirms the theory of the thermal mechanism of the degradation. An estimate was made of the degrading domain temperature on the basis of measurements of the characteristic emission current of the diode. (JPRS)

16995 TEA CO_2 LASERS, PHYSICAL PROCESSES, APPLICATIONS. Girard, G.; Farcy, J. C.; Michon, M. (Compagnie Generale d'Electricite, Marcoussis, France). Onde Electr.; 54: No. 9, 446-455(Nov 1974). (In French)

The different physical processes involved in TEA CO_2 lasers, i.e., the excitation of the gas medium and the energy extraction are discussed. Two systems are described, i.e., a high repetition rate laser which delivers a high average power and a laser delivering high energy nanosecond pulses. (Electr. Electron. Abstr.)

16996 EXCITATION MECHANISM OF 3250 AND 4416 Å LASER LINES IN THE CATAPHORETIC He–Cd LASER DISCHARGE. Miyazaki, K.; Ogata, Y.; Fujimoto, T.; Fukuda, K. (Kyoto Univ.). Jpn. J. Appl. Phys.; 13: No. 11, 1866-1874(Nov 1974).

The hook method was applied to population measurement for low-lying excited levels of He and Cd including metastable levels as well as for the ground state of Cd in the cataphoretic Hd–Cd laser discharge (3 mm bore and 685 mm long) under typical conditions for lasing. The population density of Cd ions in the 3250 Å upper level was also obtained by the line intensity measurement combined with the hook method. The results have shown that Penning collisions of ground state Cd atoms with 2^3S metastable He atoms are dominant for the excitation of 4416 and 3250 Å laser lines. The Penning-excitation cross section of 1.7×10^{-15} cm^2 and the population density of the 4416 Å upper level have been determined, which are consistent with the result so far obtained. (Electr. Electron. Abstr.)

16997 MEASUREMENTS OF THE ELECTRON ENERGY DISTRIBUTION IN AN RF SUPERPOSED-He-Ne LASER TUBE. Dote, T. (Inst. of Physical and Chemical Research, Saitama, Japan); Yamaguchi, N. J. Phys. Soc. Jpn.; 37: No. 4, 1777 (Oct 1974).

It was found that the electron population in the higher energy range augments the increase of the rf power. As a reason for the increase of the laser output power with the augmentation of the electron energy, it is considered that when the rf power is applied, the electron energy distribution shifts in a higher energy range and the electron population concerned in the laser oscillation increases. (Electr. Electron. Abstr.)

16998 STABILIZED HIGH POWER ARGON ION LASER. Nakamura, O.; Kikuchi, B. (Fujitsu Labs. Ltd., Kanagawa, Japan). Fujitsu Sci. Tech. J.; 10: No. 3, 147-171(Sep 1974).

Describes a laser for use as the light source of a holographic memory system. The vacuum sealing method of the BeO ceramics is based on glass melting realizing a high output laser discharge tube of long life. Stabilization of the resonator mount, output power and laser beam direction has been successfully realized. The general outlines and characteristics of the device are discussed. (Electr. Electron. Abstr.)

16999 ALIGNMENT TECHNIQUE FOR UNSTABLE RESONATORS. Hanlon, J.; Aiken, S. (Air Force Weapons Lab., Kirkland AFB, Albuquerque, NM). Appl. Opt.; 13: No. 11, 2461(Nov 1974).

A mirror with a small hole is centered on the cavity axis in front of the concave mirror and at 45^0 to the axis. An alignment telescope (Davidson D-275) is then used with the procedure described to align the resonator mirrors to an accuracy of about 15 mu rad. (Electr. Electron. Absts.)

17000 ELECTRO-OPTICAL TUNING OF THE CW DYE LASER AND ATTENDANT EXPERIMENTS IN SPECTROSCOPY. Telle, J. M. Ithaca, NY; Cornell Univ. (1975). 106p. University Microfilms Order No. 75-27,867.

Thesis (Ph. D.).

A method is discussed which provides, for the first time, broad band (hundreds of A) electronic tuning of the cw dye laser and data are given to verify the method. The method is electro-optical in nature. Various crystal orientations and their corresponding tuning rates (in A per kilovolt) are given. Basic filter characteristics (bandwidth, free spectral range) and resultant laser emission characteristics are also discussed. (TFD)

17001 DIELECTRIC CAVITY RAISES YAG EFFICIENCY. Hahn, Y. H.; Hahn, Y. B. (CVI Laser Corp., Albuquerque, NM). Electro-Opt. Syst. Des.; 7: 11-14(Feb 1975).

The benefits of using dielectric coated quartz cavities instead of metal-coated cavities are discussed. In range finder applications, advantages include high efficiency, long term reliability and operation, light weight and compactness, durability in extreme environments, and the possibility of operating without liquid cooling. For laser-fusion research using yttrium-aluminum garnet/neodymium: glass rods, there would be no solarization, very low loss due to depumping and lateral lasing, and rejection of distortion-causing heat. In flash lamp pumped HF, DF and iodine lasers, narrow-band pumping makes it possible to reject unwanted radiation such as uv, ir, and the lasing wavelength itself, thereby making such lasers more feasible and efficient. (IAA)

17002 NONADIABATIC EFFECTS IN THE COLLISION OF $F(^2P)$ WITH $H_2(^1SIGMA/sub\ g/^)$. I. SCF Interaction Potentials for the $1^2A'$, $2^2A'$, and $^2A''$ States in the Reactant Region. Rebentrost, F.; Lester, W. A. Jr. (IBM Research Lab., San Jose, CA). J. Chem. Phys.; 63: No. 9, 3737-3740(1 Nov 1975).

Interaction potentials for the $1^2A'$, $2^2A'$, and $^2A''$ states of the $F + H_2$ system are computed in the self-consistent field (SCF)

approximation for a range of geometries suitable for the study of nonadiabatic interactions at thermal energies. Notable features found for the energy surfaces are (a) dominance at long range of the quadrupole-quadrupole interaction, (b) strong repulsive forces at small F–H_2 separations for the excited-state surfaces, and (c) a pseudocrossing region with a conical intersection for the collinear nuclear arrangement at R(F–H_2) equals 5.2 a.u. (auth)

17003 CHEMILUMINESCENCE STUDIES. IV. Pressure-Dependent Photon Yields for Ba, Sm, and Eu Reactions with N_2O, O_3, O_2, F_2, and NF_3. Eckstrom, D. J.; Edelstein, S. A.; Huestis, D. L.; Perry, B. E.; Benson, S. W. (Stanford Research Inst., Menlo Park, CA). J. Chem. Phys.; 63: No. 9, 3828-3834(1 Nov 1975).

Chemiluminescence spectra and photon yields are presented for reactions of Ba, Sm, and Eu with N_2O, O_3, O_2, F_2, and NF_3 for the pressure range 0.5 to 20 torr. Peak yields range from 2.5 percent to 70 percent, with the reactions of Sm with NF_3 and F_2 having the highest yields. These latter reactions put from 12 percent to 16 percent of their available thermal energy into luminous output. The pressure dependence of the photon yields deduced from these and other recent measurements suggests that the initial exothermic reaction primarily populates high vibrational levels of the ground electronic state of the newly formed diatomic. Radiating states would then be populated mainly by collision-induced vibrational-to-electronic internal conversion. (auth)

17004 LATE-TIME BEHAVIOR OF AN IODINE PHOTODISSOCIATION LASER OSCILLATOR. Gusinow, M. A.; Freeman, J. R. (Sandia Labs., Albuquerque, NM). J. Appl. Phys.; 46: No. 2, 796-801(Feb 1975).

The principal experimental result is a determination of late-time lasing long after the flashlamp output has terminated. A simple model has been constructed which agrees qualitatively with the experimental results. The calculations indicate that diffusive transport may be responsible for the observed late-time lasing. (auth)

Cryogenic and Superconducting Equipment and Devices

Refer also to abstracts 16850, 16851, 16854–16857, 17225, 17697, 17698, 17702, 17760, 17833, 17888, 17906, 17910–17916, 17924, 17928, and 18744.

17005 SUPERCONDUCTING MAGNETS AND LEADS THERETO. Biltcliffe, M. N.; Hanley, P. E.; McKinnon, J. B.; Wheatley, R. W. (to Oxford Instrument Co., Ltd.). British Patent 1,404,682/B/. 3 Sep 1975. Filed date 12 Jan 1972. 4p.

The magnet described comprises a cryostat containing a superconducting coil for the generation of a magnetic field, with a short-circuiting superconducting link connected across the coil, and electrical leads extending through the cryostat to the coil; these leads are provided with joints within the cryostat to enable them to be detached from the coil and removed from the cryostat without interrupting the current through the coil, thus reducing heat conduction to the cryostat through the leads. The joints are arranged so that the leads can be readily detached and re-attached to the coil from outside the cryostat. Gas-tight seals are provided where the leads pass through the outer wall of the cryostat, with caps that can be secured after removal of the leads. This kind of magnet can provide a stable magnetic field continuously over long periods, such as is required in nuclear magnetic resonance spectrometers. (UK)

17006 CALCULATION OF COOLING OF ^{3}He BY ADIABATIC DEMAGNETIZATION OF A PARAMAGNETIC SALT. Roach, P. D. (Argonne National Lab., IL); Abraham, B. M.; Roach, P. R.; Ketterson, J. B. J. Low Temp. Phys.; 22: No. 3/4, 301-311 (Feb 1976).

In an effort to better understand the various factors involved in refrigeration by adiabatic demagnetization, we have set up a computer model of a paramagnetic salt in contact with liquid ^{3}He. This model has been used to study the cooling of the ^{3}He from an initial temperature of 20 mK, which is typical of the temperature achieved in a dilution refrigerator. The effects of various demagnetization schedules, heat leaks, and varying ratios of salt to liquid have been studied. The model was used to simulate an actual demagnetization and gave excellent agreement with measured temperatures. It is also shown how the model can be extended to the case of nuclear demagnetization. 4 figures. (auth)

17007 SURFACE PREPARATION AND MEASUREMENT OF NIOBIUM USED IN HIGH-FREQUENCY CAVITIES. Kneisel, P.; Stoltz, O.; Halbritter, J. (Univ., Karlsruhe, Ger.). J. Appl. Phys.; 45: No. 5, 2296-2301(May 1974).

To study different surface treatments (e.g., electropolishing, anodizing) on Nb high frequency cavities, the surface barrier, and surface superconductivity have been measured. These show that slow cooling in uhv furnaces may destroy the homogeneous surface layer because of nbo precipitation. Measurement of the mean free path No. 200 AA shows it does not vary with material or treatment indicating that purity of nb is not significant. However furnace treatment above 1300°C presumably removes inhomogeneities. Fast quenching is also significant. 40 references.

17008 DETERMINATION OF SUPERCONDUCTIVE TRANSITION TEMPERATURE. Mel'nikov, O. B.; Moiseev, D. P. (Physics Inst., Kiev). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 974(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 246(1975).

A mode of measuring superconductive transition temperature is proposed, using the inductive method in the range from 4.2 to 1.5°K and based on the fact that the inductance measured itself serves as a temperature stabilization sensor in the transition region. (auth)

17009 METHOD FOR INVESTIGATING THE PROPERTIES OF A SUPERCONDUCTING QUANTUM MAGNETIC-FLUX METER. Kozlov, V. A.; Kozlova, N. D.; Savitskii, E. M.; Bykov, I. I. (Metallurgy Inst., Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 975-976(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 247-248(1975).

A method is proposed for studying the properties of a superconducting quantum magnetic-flux detector, which allows a clear investigation of their dynamics. A "jump" of the resonant frequency of the tank circuit incorporating the Josephson contact is revealed along with asymmetry of the amplitude-frequency response of the tank circuit. (auth)

17010 MEASUREMENT ELEMENT OF A SUPERCONDUCTING INTERFEROMETER. Legkostupov, M. S. (Inst. of Solid-State Physics, Moscow). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 977-978(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 248-249(1975).

The construction of the measurement element of a superconducting quantum interferometer (SQUID) is described in which rigid clamping of the cylindrical rods creating the weak contact is used. The element allows monitoring and investigation of the weak spots incorporated in the ring of the SQUID. (auth)

17011 PHONON AND QUASIPARTICLE DYNAMICS IN SUPERCONDUCTING ALUMINUM TUNNEL JUNCTIONS. Smith, L.N.; Mochel, J.M. (Department of Physics and Materials Research Laboratory, University of Illinois, Urbana, Illinois 61801). Phys. Rev. Lett. 35: No. 23, 1597-1600 (8 Dec 1975).

The effect of the 2Δ recombination phonons in modifying the effective lifetime τ_{eff} for quasiparticle recombination has been determined for the first time in a double-junction experiment by comparing measurements taken both with and without a helium film covering the junctions. For a double junction made from evaporated aluminum films 300 Å thick deposited on a glass substrate, we find $\tau_{eff}/\tau_R = 8.6 \pm 1.1$ in the absence of the helium film, and, at $\Delta/kT = 6$, $\tau_R = 1.4 \pm 0.1$ μsec. (auth)

17012 JOSEPHSON JUNCTIONS IN TRANSVERSE MAGNETIC FIELDS. Hebard, A.F.; Fulton, T.A. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. Lett. 35: No. 19, 1310-1311 (10 Nov 1975).

Recent observations by Rosenstein and Chen of dc Josephson tunnel-current diffraction patterns occurring in a transverse magnetic field are ascribed to surface demagnetizing currents feeding the interior of the junction. (auth)

17013 SUPERCONDUCTIVITY: A SUBJECT OF INTEREST TO THE ATOMIC ENERGY COMMISSION. Stevens, D. K. (Atomic Energy Commission, Washington, DC). IEEE Trans. Magn.; MAG-11: No. 2, 101-104(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The interests of the Atomic Energy Commission (now the Energy Research and Development Administration) in superconductivity include applications in: (1) high energy physics; (2) controlled thermonuclear devices; (3) energy storage; (4) energy transmission; and (5) energy conversion systems. Some applied efforts centering on superconductivity technology are briefly discussed, and the research programs of the Materials Sciences Program of the Division of Physical Research are outlined. (PMA)

17014 ELECTRIC POWER RESEARCH INSTITUTE'S ROLE IN APPLYING SUPERCONDUCTIVITY TO FUTURE UTILITY SYSTEMS. Rabinowitz, M. (Electric Power Research Inst., Palo Alto, CA). IEEE Trans. Magn.; MAG-11: No. 2, 105-108 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Economics has been the single most important factor in deter-

mining the future of any new commercial technology in the United States. This criterion is in need of serious examination in view of the projected sharply increasing consumption of energy in the next few decades, particularly in the form of electricity. In order to make a smooth and meaningful transition from conventional methods of generating and transmitting electricity, a coordinated effort between all segments of the private and public domains will be required. The Electric Power Research Institute (EPRI) should play a vital role in planning for both the imminent short term, and long term national electrical energy needs; and in coordinating efforts to achieve these vital goals. If, as predicted, the U. S. power consumption increases by more than a factor of six in the next 30 years, it should be clear that it is necessary to develop high power density methods of producing and transmitting electricity. Superconductivity is the natural prime candidate for a new feasible technology that can take on this responsibility. (auth)

17015 HELIUM SUPPLY DEMAND IN FUTURE YEARS. Laverick, C. (Argonne National Lab., IL). IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 109-112(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Adequate helium will be available to the year 2000 AD to meet anticipated helium demands for present day applications and the development of new superconducting technologies of potential importance to the nation. It is almost certain that there will not be enough helium at acceptable financial and energy cost after the turn of the century to meet the needs of the many promising helium based technologies now under development. Serious consideration should be given to establishing priorities in development and application based upon their relative value to the country. In the first half of the next century, three ways of estimating helium demand lead to cumulative ranges of from 75 to 125 Gcf (economic study), 89 to 470 Gcf (projected national energy growth rates) and 154 to 328 Gcf (needs for new technologies). These needs contrast with estimated helium resources in natural gas after 2000 AD which may be as low as 10 or 126 Gcf depending upon how the federal helium program is managed and the nation's natural gas resources are utilized. The technological and financial return on a modest national investment in further helium storage and a rational long term helium program promises to be considerable. (TFD)

17016 ROLE OF SUPERCONDUCTING TRANSMISSION: A SUBJECTIVE ASSESSMENT. Fink, L. H. (Dept. of Interior, Washington, DC). IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 125-127(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Some heuristic considerations involved in evaluating research on superconducting power transmission systems are discussed: (1) the continuing of exponential growth in electric system load; (2) the resulting increase in the density of power generation and transmission; (3) the effects of technology on the environment; and (4) the conclusion that the realistic prospects are for underground transmission lines of longer lengths and higher capabilities. Objections and impediments to the advancement of the technology are presented, and the present impossibility of any forecast scenario is discussed. (PMA)

17017 SUPERCONDUCTING ROTATING MACHINES. Smith, J. L. Jr.; Kirtley, J. L. Jr.; Thullen, P. (Massachusetts Inst. of Tech., Cambridge). IEEE Trans. Magn.; MAG-11: No. 2, 128-134(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The opportunities and limitations of the applications of superconductors in rotating electric machines are given. The relevant properties of superconductors and the fundamental requirements for rotating electric machines are discussed. The current state-of-the-art of superconducting machines is reviewed. Key problems, future developments and the long range potential of superconducting machines are assessed. (auth)

17018 REVIEW OF SUPERCONDUCTING ELECTRONICS. Kamper, R. A. (National Bureau of Standards, Boulder, CO). IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 141-146(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

This review will sketch the present state of affairs in applications of Josephson junctions and SQUIDs to: magnetometry, DC and RF metrology, detection and amplification of electromagnetic signals, frequency metrology, noise thermometry and computers. It also mentions recent progress in super-stable oscillators using superconducting resonant circuits, pulse transmission lines, and thin-film devices to detect radiation or charged particles. Many of these topics are maturing nicely. (auth)

17019 RESEARCH WORK ON SUPERCONDUCTING MAGNET SYSTEMS IN GERMANY. Heinz, W. (Univ., Karlsruhe, Ger.). IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 147-153(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Various applications of sc magnets in Germany are discussed. Development in nuclear physics, especially new developments for dc and pulsed superconducting beam line magnets are reported. Research work on magnets for plasma and fusion physics concentrates on systems studies, toroidal systems, and energy storage devices and will become one of the most challenging fields for magnet builders in the future. Industrial applications of sc magnets are investigated for high speed transportation systems, sc machinery and magnetic separation devices. Programs and results are discussed. (auth)

17020 ELECTROPLATED STABILIZED MULTIFILAMENT SUPERCONDUCTOR. Agureev, V. N.; Keilin, V. E.; Klimenko, E. Yu.; Samoilov, B. N. (Inst. of Atomic Energy, Moscow). IEEE Trans. Magn.; MAG-11: No. 2, 303-304(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

This paper describes a method of manufacturing stabilized multifilament superconductors by connection of single or multifilament wires together by electroplating process. (auth)

17021 MANUFACTURE AND INITIAL TECHNICAL TESTS OF A HIGH-POWER DC CABLE WITH SUPERCONDUCTORS. Bochenek, E.; Franke, H.; Wimmershoff, R. IEEE Trans. Magn.; MAG-11: No. 2, 366-372(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The fabrication and testing of a niobium–tin strip, copper stabilized superconducting cable are described. The tests included both electric and mechanical properties. The manufacturing process is illustrated by 9 photographs. (TFD)

17022 AC LOSSES OF TRANSPOSED SUPERCONDUCTORS. Eckert, D.; Enderlein, G.; Lange, F. (Zentralinstitut fuer Festkoerperphysik und Werkstofforschung, Dresden). IEEE Trans. Magn.; MAG-11: No. 2, 377-380(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Eastham and Rhodes published results of loss measurements on transposed superconducting NbTi cables and concluded basing on an extrapolation to very large numbers of wires that transposed superconductors could be used favorably in cables for power transmission. There are some reasons to question the correctness of their extrapolation. Losses were calculated for transposed superconductors in self field and got results different from those of Eastham and Rhodes. Loss measurements were performed the results of which give evidence for the correctness of our calculations. The results lead to the conclusion that the use of transposed cables of irreversible type 2 superconductors for power transmission is not advantageous. (auth)

17023 DEVELOPMENT OF NIOBIUM–COPPER–INVAR COMPOSITE CONDUCTOR FOR AN AC SUPERCONDUCTING POWER TRANSMISSION CABLE. Beall, W. T. Jr. (Union Carbon Corp., Tarrytown, NY). IEEE Trans. Magn.; MAG-11: No. 2, 381-384(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A superconducting ac power cable has been developed using Nb/Cu/Invar composite conductors and shields in a coaxial configuration with pressurized He at 4.7 K as the primary dielectric. Two major concerns for this cable system were the accommodation of fault currents and the differential thermal expansion between the conductor assembly and the cryogenic envelope. It was shown that a Nb/Cu/Invar composite tube is capable of accommodating the fault currents as well as the differential thermal expansion. Studies of the effect of surface finish on the ac losses showed that with proper surface finish, the losses can be reduced to an acceptable level for power cable applications. The lowest 60 Hz losses measured at a peak surface magnetic field of 0.1 T correspond to 43 W per 3-phase mile for a 138 kV, 3400 MVA power cable. (auth)

17024 ORIGINATION OF THE NORMAL ZONE IN A SUPERCONDUCTING CABLE WITH PARTIAL CRYOSTATIC STABILIZATION. Blinkov, E.; Kuno, M. Ya.; Smirnov, S. K.; Bendik, N. T., Goldenberg, E. S. (Power Engineering Inst., Moscow). IEEE Trans. Magn.; MAG-11: No. 2, 389-392(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

This paper deals with the origination and variation in length of the normal zone in a superconducting cable. A convenient approxi-

mate formula for the propagation velocity of a semi-infinite zone was obtained assuming a linear decrease of critical current with increasing temperature; the peculiarities of the normal zone's growth were studied in a cable with an initial gradient of gas temperature; the process of expansion and contraction of a normal zone of finite length is described. Data are given on the experimental study of the movement of a normal zone in the three-phase superconducting cable model. (auth)

17025 PROGRESS AT BROOKHAVEN IN THE DESIGN-COOLED POWER TRANSMISSION SYSTEMS. Forsyth, E. B. (Brookhaven National Lab., Upton, NY). IEEE Trans. Magn.; MAG-11: No. 2, 393-396(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Following an extensive study of cryogenic power transmission systems under development in this country and abroad it was concluded at Brookhaven that a flexible superconducting ac cable appeared to be the best choice for an economical high-capacity underground system with superior technical characteristics. A form of niobium-tin has been developed for this application with an intrinsic low-loss performance at 60 Hz. In addition, it has been determined that the ac characteristics of many commercial forms of Nb_3Sn are degraded by additives, these effects are described. A flexible cable will require a lapped plastic insulation which must possess necessary properties both at room temperature and at the operating temperature, these are listed together with a summary of test results. Several designs for the cryogenic envelope to contain the cable are under development, the design options and trade-offs are discussed. Using performance data based on present knowledge of helium-cooled cables, systems were designed for an actual utility company transmission corridor 43 miles long rated at 4800 MVA. These designs are costed and compared to conventional transmission facilities. (auth)

17026 RAPIDLY TUNABLE SUPERCONDUCTING RESONATOR. Delayen, J. R.; Yen, H. C.; Dick, G. J.; Shepard, K. W.; Mercereau, J. E. (California Inst. of Tech., Pasadena). IEEE Trans. Magn.; MAG-11: No. 2, 408-410(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Superconducting, high Q rf resonators which are continuously tunable over at least a factor of three in frequency were designed for operation in the range of a few hundred megahertz. Prototypes of these resonators were fabricated of OFHC copper and electroplated with lead. Rf decay times of 18 msec at 240 MHz were achieved in these resonators; the rf losses which dominate the Q are found to take place in a thin dielectric layer on the superconducting lead surface. This loss mechanism decreases the decay time about a factor of 10 from the decay time expected from the measured rf resistance of the Pb surfaces. Preliminary work on rapid (less than 1 msec full range) tuning of high Q resonators, which may lead to a new technique of electromechanical energy conversion, is reported. (auth)

17027 SUPERCONDUCTING RESONATOR FOR HIGH FREQUENCY: HIGH POWER APPLICATIONS. Weinman, L. S.; Murray, H. D.; Vardiman, R. (Naval Research Lab., Washington, DC). IEEE Trans. Magn.; MAG-11: No. 2, 411-412(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Superconducting helical resonators operating in the hf band at approximately 16 MHz were designed and constructed to demonstrate the feasibility of passing a kilowatt of power at an operation Q of 1000 (Q/sub DL/ equals 1000). Superconducting components are being considered to replace normal state circuits in communication systems, i.e., antennas and multicouplers. (A multicoupler is a device using coupled resonators which permits a number of transmitters to be simultaneously operated into one antenna.) The niobium helical resonators were polished and anodized after fabrication by electron-beam welding. Teflon support structures were designed to minimize vibrational problems. The resonator was operated open to the helium bath, and the resulting unloaded Q was in excess of 4×10^6. A kilowatt of power was transferred through the resonator when operating at a Q/sub DL/ of 1000. Work is now proceeding on the design and fabrication of a tunable resonator. (auth)

17028 ROLE OF ELECTRONS IN rf BREAKDOWN. Lyneis, C. M. (Stanford Univ., CA); Kneisel, P.; Stoltz, O.; Halbritter, J. IEEE Trans. Magn.; MAG-11: No. 2, 417-419(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Measurements on two types of S-band single-cell cavities are reported. These investigations were directed toward questions concerning the location and mechanisms of magnetic field breakdown in these cavities. The results show that in TM modes, the surface electric fields are an important factor in the initiation of rf breakdown. Among the mechanisms for rf breakdown are: (1) localized heating initiated by multipacting electrons; (2) deterioration of the superconducting properties through the impact of electrons; and (3) inherent inhomogeneities in the surface. In order to reduce the electron loading and subsequent field limitation, careful treatments were applied to the surface. As a result, fields of 81 mT in an electron free mode and 40 mT and 25 MV/m in TM modes were attained in one type of cavity. In the other type cavity 67 mT and 38 MV/m were attained. (auth)

17029 SUPERCONDUCTING Nb_3Sn-CAVITIES. Hillenbrand, B.; Martens, H.; Pfister, H.; Schnitzke, K.; Ziegler, G. (Siemens AG, Research Labs., Erlangen, Ger.). IEEE Trans. Magn.; MAG-11: No. 2, 420-422(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Microwave critical magnetic flux densities B/sub c//sup ac/ up to 160 mT and higher than B/sub c1/ were obtained with niobium cavities by special surface treatments. Breakdown in this flux density region occurs by a thermal breakdown mechanism in which no superconducting critical flux density is involved. Considerable increase in B/sub c//sup ac/ may be expected with high T/sub c/ superconductors such as Nb_3Sn. Nb_3Sn layers were produced on niobium structures by exposing them to a saturated Sn vapor at 1000^0C. B/sub c//sup ac/ values up to 40 mT and surface resistances smaller than 10^{-6} OMEGA were measured with TE_{011} cavities at 9.5 GHz. (auth)

17030 EFFECT OF SURFACE METALLURGY ON THE PENETRATION DEPTH AND rf BREAKDOWN FIELD OF SUPERCONDUCTING NIOBIUM. Varmazis, C.; Luhman, T. S.; Joshi, A.; Kammerer, O. F.; Giordano, S.; Strongin, M. (Brookhaven National Lab., Upton, NY). IEEE Trans. Magn.; MAG-11: No. 2, 423-426(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The surface metallurgy of niobium is discussed, including factors such as impurity distributions at the surface and surface topography. Measurements of the penetration depth are presented both in the clean limit, where there is about a 20 A region of oxygen at the surface (after high temperature heat treatment) affecting the boundary condition on the GL order parameter; and in the dirty limit, where heating in an oxygen atmosphere near 10^{-6} torr can greatly affect the surface roughness. Auger measurements of the surface conditions in a 1 percent Zr in Nb alloy are also presented. A discussion is given of preliminary results in a special apparatus where rf breakdown experiments can be performed on small samples and correlated with the metallurgical factors mentioned above. (auth)

17031 rf RESIDUAL LOSSES AND PHONON GENERATION. Halbritter, J. (Kernforschungszentrum, Karlsruhe, Ger.). IEEE Trans. Magn.; MAG-11: No. 2, 427-430(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

One restriction against applying superconducting rf cavities is the achievable rf residual surface resistance R/sub res/, especially after surface damage. A theory is presented, where by interfacial quantum mechanic exchange between conduction band and localized states occurs, and momentum of the shielding current is transferred to the traps. For rf shielding currents, this oscillating force on the localized states coherently generates transverse phonons. This transfer of momentum, due to the overlap of band and trap states, corresponds to an rf residual resistance which describes consistently the observed R/sub res/. In addition, the presented theory explains microscopically the observed rf-phonon-coupling. (auth)

17032 SURFACE IMPEDANCE OF TYPE II SUPERCONDUCTORS IN THE MIXED STATE. Petrovich, A.; Rose, R. M. (Massachusetts Inst. of Tech., Cambridge). IEEE Trans. Magn.; MAG-11: No. 2, 431-433(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Using a quarter wave coaxial resonator containing the superconducting sample as the center element, the resistive and reactive components of the surface impedance were measured on niobium over the entire static H-field range of the mixed state at frequencies between 70 MHz and 930 MHz. The samples included one in the plastically deformed condition and one which had been annealed at 1800^0C for 2 hours in a vacuum of 7×10^{-8} torr; both had about the same resistivity ratio (approximately 14). The two samples differed considerably in the ratio of the resistive to reactive component of the surface impedance. The phenomena is believed to be a consequence of the nature of the electronic excitations characterizing the fluxoid cores. (auth)

17033 MICROWAVE SURFACE RESISTANCE OF A SUPERCONDUCTING Mo–Re ALLOY. Yasaitis, J. A.; Rose, R. M. (Massachusetts Inst. of Tech., Cambridge). IEEE Trans. Magn.; MAG-11: No. 2, 434-436(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

By using a $Mo_{0.75}Re_{0.25}$ alloy endplate on a Nb microwave cavity (TE_{011} mode, resonant at 11.2 GHz), an upper bound for the residual surface resistance of this alloy was shown to be 2.8 mu-ohm; a lower bound for the breakdown field was shown to be 102 G. In view of the fact that these properties were determined at 11.2 GHz on the first Mo–Re endplate made with no particular effort devoted to optimization of surface quality, this material is deserving of further consideration for practical microwave applications. (auth)

17034 INVESTIGATION OF MICROWAVE PROPERTIES OF SUPERCONDUCTING $Nb_{0.4}Ti_{0.6}$. Giordano, S. (Brookhaven National Lab., Upton, NY); Hahn, H.; Halama, H. J.; Luhman, T. S.; Bauer, W. IEEE Trans. Magn.; MAG-11: No. 2, 437-440 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A superconducting $Nb_{0.4}Ti_{0.6}$ test cavity was constructed to measure the surface losses as function of frequency in the range from 2 to 8 GHz and as a function of temperature below 4.2 K. The temperature-dependent part of the surface resistance agrees essentially with the BCS theory of the material parameters T/sub c/ equals 9.8 K, DELTA(0) equals 1.73 k/sub B/T/sub c/, xi_0 equals 380 A, lambda/sub L/ equals 310 A, and l equals 4 to 8 A are taken. The magnitude and frequency dependence of the temperature-independent residual resistance observed in the niobium titanium cavity suggests no difference in the behavior of type I and II superconductors. The highest Q_0 equals 2.9×10^9 was measured in the TE_{011} mode at 3.9 GHz. A coaxial cavity with removable sample was constructed for an in-depth study of rf breakdown and its relationship with metallurgical parameters as characterized by ac loss, magnetization, and penetration depth measurements. Peak fields in solid type-II superconducting cavities are limited by their low thermal conductivity, suggesting the use of films, 0.01 to 0.1 mm thick, on pure niobium or copper. The highest magnetic field (120 G) was measured on a recrystallized sample, suggesting that the lower critical field, H/sub c1/, (for this sample 75 G) does not prevent the application of high-T/sub c/ type-II superconductors to microwave devices. (auth)

17035 SUPERCONDUCTING MICROWAVE ENGINE. Dick, G. J. (California Inst. of Tech., Pasadena). IEEE Trans. Magn.; MAG-11: No. 2, 441-442(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A new technique of electromechanical energy conversion is proposed. This technique would make use of the high quality factors attainable in superconducting resonators to achieve direct mechanical to microwave energy conversion with a net efficiency greater than 90 percent, a value which is far higher than that obtained by conventional techniques. In addition, if surface magnetic and electric field levels are limited by the critical fields obtained in fixed resonators, power densities would be achieved which are large enough to make such a machine a practical means both for generating microwave energy and for reconverting the microwave again to mechanical energy for power transmission purposes. (auth)

17036 SUPERCONDUCTIVE ENERGY STORAGE FOR LARGE SYSTEMS. Boom, R. W.; Haimson, B. C.; McIntosh, G. E.; Peterson, H. A.; Young, W. C. (Univ. of Wisconsin, Madison). IEEE Trans. Magn.; MAG-11: No. 2, 475-481 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A summary report of a three-year study of superconductive energy storage for large utility systems is presented. The preferred conceptual design choices include: large, thin-walled solenoids, 1.8°K cooling, TiNb in aluminum composite conductors at 5 tesla, bedrock structural support for both axial and radial forces, and a three-phase Graetz (ac/dc) bridge converter interface to the power grid. Preliminary estimates show that capital costs are given by $/kW equals 40 + 125 (P/1000)/sup -1/3/ (t/2)/sup 1/3/ where P is the average power in MW and t is the discharge (peaking) time in hours. A typical operating loss is 10 to 15 percent of the stored energy. The concept is technically feasible requiring only present day technology. (auth)

17037 WILL SUPERCONDUCTING MAGNETIC ENERGY STORAGE BE USED ON ELECTRIC UTILITY SYSTEMS. Hassenzah, W. V. (Los Alamos Scientific Lab., NM). IEEE Trans. Magn.; MAG-11: No. 2, 482-488(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

As the cost of fossil fuel has increased and the load factors on electric utilities have decreased, the need for efficient, reliable energy storage systems has increased. Although pumped hydro storage is now used extensively on those utility systems having the appropriate resources nearby, it is only 65 percent efficient. Superconducting magnetic energy storage, which promises to be more than 90 percent efficient and easily sited, may become a competitive energy storage technology. A comparison of the various energy storage systems is presented in terms of performance on electric power systems and cost. Emphasis is given to the various technologies involved in the development of large superconducting magnets. A brief review of the Los Alamos Scientific Laboratory program on superconducting magnetic energy storage is included. (auth)

17038 INDUCTIVE SHIELDING FOR PULSED ENERGY STORAGE MAGNETS. Moses, R. W. Jr.; Ballou, J. K. (Univ. of Wisconsin, Madison). IEEE Trans. Magn.; MAG-11: No. 2, 493-496(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The design of a shield winding to be placed around a superconductive magnet is discussed. By operating the shield and main winding in parallel, it is possible to transfer energy to and from the magnet system without exposing the superconductive coil to a changing field, thereby eliminating ac losses in the superconductor and stabilizer. Such units have applications for CTR devices and for load leveling the power demand of the main ring at the Fermi National Accelerator Laboratory. (auth)

17039 EXTERNAL FIELD PRODUCTION OF SUPERCONDUCTING ENERGY STORAGE SOLENOIDS. Ballou, J. K.; Moses, R. W. Jr. (Oak Ridge National Lab., TN). IEEE Trans. Magn.; MAG-11: No. 2, 497-499(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The external multipole field of a superconducting solenoid is evaluated for large units buried in bedrock. Methods to partially cancel these fields are discussed. It is shown that external magnetic field "pollution" can be reduced at modest system expense. (auth)

17040 CELLULAR CONCRETE: A POTENTIAL LOAD-BEARING INSULATION FOR CRYOGENIC APPLICATIONS. Richard, T. G.; Dobogai, J. A.; Gerhardt, T. D.; Young, W. C. (Univ. of Wisconsin, Madison). IEEE Trans. Magn.; MAG-11: No. 2, 500-503(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The need for low cost, low thermal conductivity, high strength insulation suitable for cryogenic applications is becoming more evident. An investigation of the potential of cellular concretes to fulfill this function was initiated. A review of the thermal and mechanical characteristics of foamed plastics and cellular concrete is presented along with relative cost comparisons. Test data from preliminary investigations is presented to define the influence of material constituents, density, and temperature on the mechanical and thermal response of cellular concrete. Specimen densities range from 0.64 to 1.44 gr/cc. The influence of temperature variations from 22°C to -196°C is reported for selected densities. (auth)

17041 DIAMAGNETIC FORCES IN SUPERCONDUCTING MAGNETS. Stevenson, R. (McGill Univ., Montreal); Atherton, D. L. IEEE Trans. Magn.; MAG-11: No. 2, 528-531(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Damage to two large superconducting solenoids was caused by axial expansion forces and radial compression forces. These forces, which can be greater than and are of opposite sense to the classical Lorentz forces, are attributed to the diamagnetism of the composite superconductors. Some irregularities experienced in the operation of force cooled superconducting magnet systems appear to be readily understood by considering diamagnetic forces. It seems likely that several other previously unexplained occurrences in the operation of large superconducting magnets will also eventually be attributed to this effect. The mechanisms by which diamagnetic properties of superconducting strips produce repulsive forces on opposite edges of the strips are described. At the end pancake and innermost layer of a solenoid, these forces are seriously unbalanced and may override the Lorentz forces. The magnitude of these forces may be estimated and their effects may be minimized. It is suggested that the stress analysis of large superconducting magnets currently in operation or in design be reviewed to consider the relevance of diamagnetic forces to their safe operation. (auth)

17042 CONTROL OF TRAINING IN RACETRACK SHAPED SUPERCONDUCTING MAGNETS. Edwards, V. W.; Scott, C. A.; Wilson, M. N. (Rutherford Lab., Chilton, Eng.). IEEE Trans. Magn.; MAG-11: No. 2, 532-535(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A series of experiments is described on small straight-sided (racetrack) magnets designed to investigate the influence of the force support structure on training. It was demonstrated in windings typical of those used in large magnets that training can be eliminated by correct clamping of the windings and that it can be re-introduced by poor clamping. This behavior was found for several quite different types of winding impregnation and was also confirmed at temperatures down to 2.3^{0}K. (auth)

17043 LOW TEMPERATURE PROPERTIES OF POTTING AND STRUCTURAL MATERIALS FOR SUPERCONDUCTING MAGNETS. Hartwig, G. (Kernforschungszentrum, Karlsruhe, Ger.). IEEE Trans. Magn.; MAG-11: No. 2, 536-539(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The embedding of superconductors is one component determining the behavior, such as training characteristics or degradation, of superconducting coil assemblies. Mechanical, thermomechanical, and electrical properties of potting or structural materials are discussed. A review of low temperature measurements of parameters, such as elastic moduli, work of fracture, thermal contraction and conductivity, specific heat, and breakdown voltage on unfilled, filled or reinforced epoxy resins is given. (auth)

17044 COMPOSITE SUPERCONDUCTOR DESIGN FOR LARGE MAGNETS. Hay, R. D.; Tarrh, J. M. (Magnetic Engineering Associates, Inc., Cambridge, MA). IEEE Trans. Magn.; MAG-11: No. 2, 540-543(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The correct specification of superconductor characteristics is of fundamental importance to the performance and optimization of a magnet. Design criteria are presented for NbTi multifilamentary composite superconductors for large magnets. Expressions are developed relating conductor configuration to current density, magnetic field, superconductor area, temperature, thermal stability criteria, and magnet protection. Optimization of these conductor characteristics in a magnet includes consideration of current density regionalization, or grading, to minimize the required amount of superconductor without impairing performance. Standardization of conductors is proposed. (auth)

17045 FLUX DIFFUSION LOSSES IN STABILIZED CONDUCTORS. Hilal, M. A.; Boom, R. W. (Univ. of Wisconsin, Madison). IEEE Trans. Magn.; MAG-11: No. 2, 544-547(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The ac losses in normal metal sheaths around superconductor composites are calculated. Three cases are considered: (1) the composite region is assumed to have a finite constant resistance; (2) flux lines are assumed to move from the normal metal into the superconductor at constant velocity; and (3) complete equations of motion and continuity of flux are used in both the normal and superconductor region. Case (1) is incorrect since it predicts a decrease in losses for an increase in rate of change of applied magnetic field, in contradiction to case (3). Case (3) is, of course, complete and accurate but complex enough to require numerical solutions. Case (2) however is only in error by a few percent for charging rates in the order of one tesla/h. Case (3) can be applied for any charging rate as long as the superconductor filaments are transposed, not just twisted. (auth)

17046 SUPERCONDUCTIVITY TO THE RESCUE. McCracken, R. J.; Richied, D. E.; Toohig, T. E. IEEE Trans. Magn.; MAG-11: No. 2, 551-554(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

There are many large, useful electromagnets in service in laboratories throughout the world that are faced with common problems: i.e., incipient failure due to age, ever present desire for higher fields, and staggering escalation of power costs. Conventional rewind is generally not feasible due to magnet configuration and continuing high operating costs. A unique engineering approach is presented for the modification of existing exciting coils to operate in a superconducting mode using proven state of the art techniques and considerable cost savings over the fabrication of new superconducting coil packages using more conventional coil packaging. Typical cost analyses show the attractive use of such proposals. (auth)

17047 MULTIFILAMENTARY NIOBIUM TIN SOLENOIDS. Larbalestier, D. C. (Rutherford Lab., Chilton, Eng.); Edwards, V. W.; Lee, J. A.; Scott, C. A.; Wilson, M. N. IEEE Trans. Magn.; MAG-11: No. 2, 555-558(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sept 1974). See CONF-740957-.

The construction and performance of several small solenoids wound from filamentary composite wires are described. The Nb_3Sn is formed in the wire after winding by a high temperature treatment. The maximum field obtained was 12.2 Tesla, produced by placing a 9.9 Tesla Nb_3Sn solenoid in the backing field of a 6.5 Tesla Nb–Ti solenoid. The working current densities are substantially greater than those obtained with Nb–Ti.

17048 SUPERCONDUCTING Nb_3Sn SOLENOIDS OPERATING AT 15 TO 16.5 T. Fietz, W. A.; Mains, E. F.; Swartz, P. S.; Knopp, E. G.; Markiewicz, W. D.; Rosner, C. H. (Intermagnetics General Corp., Guilderland, NY). IEEE Trans. Magn.; MAG-11: No. 2, 559-562(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Present state of the art in tape wound Nb_3Sn solenoids is the generation of magnetic fields above 15T in clear bore diameters up to 65 mm. Details of the construction and operation of magnets of this type, especially the first one which achieved 15.8T in a 26 mm bore at 4.2^{0}K are given. The operation of this solenoid at reduced temperatures in a pumped helium bath is described. The solenoid was operated at various temperatures to below 3^{0}K where a maximum field of 16.5T was observed, limited only by mechanical strength. The prospect of achieving even higher fields at 4.2^{0}K and lower temperatures is discussed in terms of the properties of Nb_3Sn and practical design considerations. (auth)

17049 DESIGN OF A 2T SUPERCONDUCTING SOLENOID FOR MAGNETIC CATHETER GUIDANCE. Hale, J. R.; Pierce, N. T.; Hoenig, M. O. (Massachusetts Inst. of Tech., Cambridge). IEEE Trans. Magn.; MAG-11: No. 2, 563-564(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Results are reported of a research program directed toward the perfection and use of a magnetically guided catheter system for use in the cerebrovascular system. The design, construction, and operating parameters of a superconducting magnet system for medical use are described. This design was carried out with the idea foremost in mind of producing a neurosurgical tool that was easy to use in a hospital environment. This required the use of a vacuum insulated liquid helium dewar that could operate in any orientation while helium transfer was taking place, and a flexible, vacuum insulated helium transfer line. The system is completely self-contained, the only external connections being to the dc power source for magnet excitation, and 110 vac for housekeeping functions. (auth)

17050 COOLING OF A SYSTEM OF SUPERCONDUCTING MAGNETS BY MEANS OF PUMPED SUBCOOLED LIQUID HELIUM. Vander Arend, P. C. (Cryogenic Consultants, Inc., Allentown, PA); Stoy, S. T.; Richied, D. IEEE Trans. Magn.; MAG-11: No. 2, 565-568(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

In the course of developing the refrigeration system for the Fermi National Accelerator Laboratory energy doubler, a new concept was developed for the cooling of long, superconducting magnet systems. The concept depends on: (1) the use of pumps for the transport of liquid helium and refrigeration; and (2) heat transfer between a stream of boiling helium and one of subcooled liquid helium for maintenance of a constant temperature of the fluid surrounding the magnet windings. In order to verify the validity of the concept, an experimental program at Fermilab was started. The experimental installation and some of the test results obtained during a number of test runs are described. (auth)

17051 DENSE SUPERCRITICAL-HELIUM COOLED SUPERCONDUCTORS FOR LARGE HIGH FIELD STABILIZED MAGNETS. Hoenig, M. O.; Montgomery, D. B. (Massachusetts Inst. of Tech., Cambridge). IEEE Trans. Magn.; MAG-11: No. 2, 569-572(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

An analytical model was developed of a dense, supercritical helium-cooled superconductor, stabilized to withstand short-term instabilities. The model allows for the absorption of energy from transient instabilities and Joule heating during current sharing. Coolant heat transfer parameters are optimized with respect to geometry and superconductor critical temperatures. Data are presented to demonstrate the advantages of a novel extended

surface conductor bundle. This work was directed at large, high-field magnets in the 5 to 9 Telsa range. Conceptual designs of a toroidal "Tokamak" coil of 6 meter minor diameter and a 10 m long x 2,5 m diameter saddle-wound MHD magnet are presented. (auth)

17052 FLOW INSTABILITIES IN GAS-COOLED CRYOGENIC CURRENT LEADS. Thullen, P.; Stecher, R. Jr.; Bejan, A. (Massachusetts Inst. of Tech., Cambridge). IEEE Trans. Magn.; MAG-11: No. 2, 573-575(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Gas-cooled cryogenic electric current leads, operating at high ratios of current to mass flow, are commonly used to supply electric current to superconducting magnets. Loss of coolant flow under such operating conditions will result in destruction of the lead and possible damage to the magnet itself. A flow instability which results in loss of coolant flow can occur in current leads due to the dependence of the kinematic viscosity of the coolant on the local temperature. The physical basis of the instability is discussed and an analysis of the operation of current leads used in the EPRI-MIT 2000 kVA superconducting alternator is described. Details of the lead design and test results are included. (auth)

17053 THERMALLY SWITCHED FLUX PUMP. Homer, G. J.; Houzego, P. J.; Scott, C. A.; Wilson, M. N. (Rutherford Lab., Chilton, Eng.). IEEE Trans. Magn.; MAG-11: No. 2, 576-579(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A description is given of a superconducting power supply (flux pump) of the transformer rectifier type, in which the rectification is produced by thermal switching. The supply is intended for use with a superconducting magnet. At an operating current of 1000A, the pump can charge a magnet at about 20 W with an efficiency greater than 93 percent. In separate battery tests, the pump developed 38 W at a current of 1500A. Design of an improved 1500A, 500 W supply is in progress. (auth)

17054 SLOW CYCLING FLUX PUMP USING DIGITAL CONTROL. Droege, T. F. (Fermi National Accelerator Lab., Batavia, IL); Purcell, J. R.; Wang, S. T. IEEE Trans. Magn.; MAG-11: No. 2, 580-581(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A slow cycling flux pump was constructed with digital logic driving a high power operational amplifier for control. Hall sensors allow closed loop control of the secondary currents, allowing switching of the heater driven power cryotrons at the optimum time. Operating efficiency of 87 percent was achieved. (auth)

17055 ADJACENT CONDUCTOR FIELD CORRECTIONS TO HIGH CRITICAL CURRENT SHORT SAMPLE MEASUREMENTS. Miranda, G. A.; Rogers, J. D. (Los Alamos Scientific Lab., NM). IEEE Trans. Magn.; MAG-11: No. 2, 582-585(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The critical current was measured of several superconductors to 24 kA in magnetic fields to 4,5 T. The samples were hairpin shaped with the straight section under test in a perpendicularly applied field. The proximity of the straight parts causes the field of the current in one leg to change the applied field in the other leg. The measured results were corrected for this adjacent conductor field (ACF), resulting in data for uniform applied fields. One conductor, used in a 300 kJ magnet, was a single-layer, edge-wound coil, rated near 9,8 kA using the uniform field data. Under test, the magnet reached 12,5 kA, giving no sign of approaching the critical current. The "excess current" is due to the field gradient across the conductor in this coil. One contribution is due to the variation of j/sub c/ with the field value within the conductor. A second contribution results from the position dependent anisotropy of the filaments. It may be convenient to choose the definition I/sub c/ to be the current at which the sample generates an electric field of 3.5 mu V/m. If 46 mu V/m were chosen, I/sub c/ would rise approximately 0.86 kA at 17 kG. (auth)

17056 INVESTIGATIONS FOR THE DEVELOPMENT OF SUPERCONDUCTING POWER SWITCHES. Grawatsch, K. (Kernforschungsanlage, Juelich, Ger.); Koefler, H.; Komarek, P.; Kornmann, H.; Ulbricht, A. IEEE Trans. Magn.; MAG-11: No. 2, 586-589(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The transmission behavior of NbTi foils, NbTi multifilament wires in a CuNi matrix, and of NbN sputtering sheets was investigated and compared under different switching modes. Suitability for switching of 50 Hz ac current was shown. Based on the results at 1200 A, a switch for a 12 kJ-superconducting storage coil (the basic step in a project for the development of superconducting storage systems) was built. The switching time with and without load current was investigated for different amplitude of current pulses. (auth)

17057 SUPERCONDUCTING SWITCHES USING RADIATION INDUCED QUENCHING. Schmieder, R. W. (Sandia Labs., Livermore, CA). IEEE Trans. Magn.; MAG-11: No. 2, 590-593 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The use of penetrating radiation such as x-rays or high energy electrons to cause quenching of a superconducting short across an inductive energy store, thereby switching the persistent current into an external load, is examined. The basic equations describing this process within the two-fluid model are presented, and estimates of the size of megampere switches are made. The ratio of switching energy to switched energy is derived, and x-ray vs. electron impact quenching is discussed. Several geometries for practical switches are presented. (auth)

17058 DEVELOPMENT OF A SUPERCONDUCTING SWITCH FOR MAGNETIC ENERGY STORAGE SYSTEMS. Lindsay, J. D. G.; Blevens, D. J.; Laquer, H. L.; Miranda, G. A.; Rogers, J. D.; Swannack, C. E.; Weldon, D. M. (Los Alamos Scientific Lab., NM). IEEE Trans. Magn.; MAG-11: No. 2, 594-597(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Some of the problems encountered in constructing superconducting switches for magnetic energy storage systems are discussed. Empirical rules are given which assure that a switch is driven fully normal when triggered, and some of the possible geometrical arrangements for switches are considered. Results of energy transfer experiments from 20 kJ and 300 kJ superconducting energy storage systems using superconducting switches are given. (auth)

17059 PERFORMANCE CHARACTERISTICS OF THE U.VA. SUPERCONDUCTING WIND TUNNEL BALANCE. Humphris, R. R.; Zapata, R. N.; Bankard, C. H. (Univ. of Virginia, Charlottesville). IEEE Trans. Magn.; MAG-11: No. 2, 598-601(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Initial operational characteristics of a wind tunnel electromagnetic balance utilizing superconducting coils are reported. Both dc and ac superconducting coils are used for balancing and measuring 3-component aerodynamic forces on simple models in Mach 3, room temperature flow. Liquid helium boil-off measurements, corresponding to a wide range of operating conditions, are presented, together with results of systematic ac losses scaling experiments using various pancake coils wound with superconducting tape. This unique prototype facility is primarily for studying the practical feasibility of using superconducting magnetic suspension techniques for aerodynamic testing and for accumulating the knowledge and expertise required for extrapolating these techniques to large-scale facilities. (auth)

17060 APPLICATION OF SUPERCONDUCTIVITY TO MAGNETIC SEPARATION. Marston, P. G. (Magnetic Engineering Associates, Inc., Cambridge, MA). IEEE Trans. Magn.; MAG-11: No. 2, 602-603(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois USA (30 Sep 1974). See CONF-740957-.

Although magnetic separation may become the first industrial application of superconductivity, its advantages do not appear to be as great as anticipated. (auth)

17061 COMPARISON AND OPTIMIZATION OF LIFT AND DRAG FORCES ON VEHICLES LEVITATED BY EDDY CURRENT REPULSION FOR VARIOUS NULL AND NORMAL FLUX MAGNETS WITH ONE OR TWO TRACKS. Hogan, J. R.; Fink, J. J. (Univ. of California, Davis). IEEE Trans. Magn.; MAG-11: No. 2, 604-607(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Lift and drag forces are compared for various null and normal flux superconducting magnet configurations, where each coil consists of a pair of infinitely long parallel wires separated by a fixed distance. The null-flux configuration has a minimum in the drag to lift ratio for a particular value of I^2/W (I equals magnet current, W equals vehicle weight) when the vehicle cruises freely at constant speed. This calculation takes into account losses due to non-uniform eddy-current density distribution in the solid track. Results indicate that the null-flux configuration is the most efficient design, followed by the normal-flux, single track config-

uration. All other schemes are less efficient for a thin track configuration. A general method is outlined for calculating the zero-torque case. (auth)

17062 SUPERCONDUCTING LEVITATED HIGH SPEED GROUND TRANSPORTATION PROJECT IN JAPAN. Ohtsuka, T.; Kyotani, Y. (Tohoku Univ., Sendai). IEEE Trans. Magn.; MAG-11: No. 2, 608-614(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

An outline of the magnetic levitation project in Japan is given. Research was concentrated on levitation system utilizing electromagnetic repulsive force between a normal metal track and onboard superconducting magnets. Development of levitation magnets together with other items basic for a levitation system is given. (auth)

17063 US DEPARTMENT OF TRANSPORTATION PROGRAM IN MAGNETIC SUSPENSION (REPULSION CONCEPT). Reitz, J. R.; Borcherts, R. H. (Ford Motor Co., Dearborn, MI). IEEE Trans. Magn.; MAG-11: No. 2, 615-618(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The Tracked Magnetically Levitated Vehicle (TMLV) Technology Program is concerned with the use of magnetic levitation for suspension of high-speed ground vehicles traveling at speeds of 480 km/h. The program is designed to permit a comparative evaluation of two competing magnetic levitation (MAGLEV) concepts—repulsion and attraction. The program has two major tasks: (1) conceptual design of a passenger-carrying system which meets a specified ride quality objective; and (2) design and test of a high-speed (480 km/h) rocket-propelled test vehicle capable of providing engineering data relevant to the aforementioned conceptual design. Both parts of the program are discussed, with emphasis on the superconducting magnets used in the levitation/guidance systems. (auth)

17064 SUPERCONDUCTING MAGNET WITH TUBE-TYPE CRYOSTAT FOR MAGNETICALLY SUSPENDED TRAIN. Kimura, H. (Central Research Lab., Hitachi Ltd., Tokyo); Ogata, H.; Sato, S.; Saito, R.; Tada, N. IEEE Trans. Magn.; MAG-11: No. 2, 619-622(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

In order to develop a compact and lightweight superconducting vehicle magnet for a magnetically suspended high speed train, a superconducting magnet with a tube-type cryostat was constructed and tested. The superconducting coil is rectangular, with a length of 1.5 m and a width of 0.6 m, and coaxial vessels of the cryostat cover the coil winding. The liquid helium vessel and the outer vacuum vessel of the cryostat have an outside diameter of 8 cm and 14 cm, respectively. The experimental results and the evaluation for the magnet are described. (auth)

17065 REVIEW OF THE MAGNEPLANE PROJECT. Tang, C. H.; Harrold, W. J.; Chu, R. S. (Raytheon Co., Wayland, MA). IEEE Trans. Magn.; MAG-11: No. 2, 623-626(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The Magneplane is a magnetically propelled and suspended vehicle for high speed ground transportation. The design represents an attractive transportation option applicable to various transportation corridors. Various development efforts associated with the project are highlighted, and recent results of the study are reported. (auth)

17066 SUPERCONDUCTING MAGLEV AND LSM DEVELOPMENT IN CANADA. Atherton, D. L.; Eastham, A. R. (Queen's Univ., Kingston, Ont.). IEEE Trans. Magn.; MAG-11: No. 2, 627-632(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Studies on the use of superconducting magnets for levitation, synchronous propulsion, and guidance of high speed intercity ground transportation in Canada are reported. For a 100 passenger vehicle weighing 300 kN, a levitation height of 22 cm at 480 km/hr is obtained by the interaction of eight 3.85×10^5 amp turn 100 x 30 cm magnets with eddy currents induced in two 80 x 1 cm aluminum guideway strips. In low speed sections, aluminum thickness is graded to 3 cm to maintain total drag (aerodynamic and magnetic) almost speed independent. The variable speed LSM uses fifty 5×10^5 amp turn 40 x 150 cm magnets on a half pitch of 45 cms. The motor, with split 3-phase guideway windings energized in 5 km block lengths, has 72 percent efficiency and a 0.82 power factor. A favored guidance scheme for a flat-topped elevated guideway (minimizing snow accumulation) uses the interactions of the propulsion magnets with flat null-flux loops overlying the LSM windings and with the edges of the levitation strips. This scheme produces a lateral stiffness of 10^6 N/m and a maximum guidance force equal to vehicle weight. The Canadian test facility, presently being commissioned, uses full scale magnets and a 7.6 m diameter wheel rotated about a vertical axis with a maximum peripheral speed of 100 km/hr. (auth)

17067 J-8 SUPERCONDUCTING dc MACHINES: CONCERNING MAINLY CIVIL MARINE PROPULSION BUT WITH MENTION OF INDUSTRIAL APPLICATIONS. Appleton, A. D. (International Research and Development Co. Ltd., Newcastle upon Tyne, Eng.). IEEE Trans. Magn.; MAG-11: No. 2, 633-639(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The current status of superconducting dc motors and generators is discussed, with particular regard to civil marine propulsion. A brief account of the factors which help to ensure reliability is given, and the advantages which are expected from superconducting dc marine propulsion systems are enumerated. A practical demonstration of marine propulsion is briefly discussed, and the general market for the machines is assessed. Also, included are some industrial applications for these new machines. (auth)

17068 HIGH SPEED SUPERCONDUCTING ROTOR. Parker, J. H, Jr. (Westinghouse Research Labs., Pittsburgh); Blaugher, R. D.; Patterson, A.; Veccio, P. D. IEEE Trans. Magn.; MAG-11: No. 2, 640-645(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

As a result of the predicted savings in weight and volume offered by superconducting field windings, the USAF initiated a technology advancement program on superconducting machines. The initial phase of this program was devoted to the preliminary design and analysis of certain critical components judged to be essential in constructing a high speed, high power superconducting generator suitable for airborne application. As a final feasibility test, the most critical components, i.e., the dynamic cryogenic seals, power leads, and superconducting field winding, were to be assembled into a complete working rotor and tested under full operating conditions. The overall design, fabrication, and final test results of a prototype 12,000 rpm 4-pole superconducting rotor are reviewed. The main emphasis is placed on the design, fabrication and test of the superconducting coils, and on the description of the cryogenic cooling scheme for the 4-pole coil structure. (auth)

17069 SUPERCONDUCTING THREE ELEMENT SYNCHRONOUS AC MACHINE. Boyer, L. (LGEP-LCIE BP, Fontenay-aux-Roses, France); Chabrerie, J. P.; Mailfert, A.; Renard, M. IEEE Trans. Magn.; MAG-11: No. 2, 646-649(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

There is a growing interest in ac superconducting machines. Of several new concepts proposed for these machines in the last years one of the most promising seems to be the "three elements" concept which allows the cancellation of the torque acting on the superconducting field winding, thus overcoming some of the major constraints. This concept leads to a device of induction-type generator. A synchronous, three element superconducting ac machine is described, in which a room temperature, dc fed rotating winding is inserted between the superconducting field winding and the ac armature. The steady-state machine theory is developed, the flux linkages are established, and the torque expressions are derived. The condition for zero torque on the field winding, as well as the resulting electrical equations of the machine, are given. The theoretical behavior of the machine is studied, using phasor diagrams and assuming for the superconducting field winding either a constant current or a constant flux condition. (auth)

17070 PROTECTION OF SUPERCONDUCTING FIELD WINDINGS FOR ELECTRICAL MACHINES BY THE USE OF AN INERTIAL FREE ELECTROMECHANICAL SHIELD. Dagalakis, N.; Kirtley, J. L, Jr. (Massachusetts Inst. of Tech., Cambridge). IEEE Trans. Magn.; MAG-11: No. 2, 650-652(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A new machine has two independent rotors, the driven inner rotor with the superconducting field winding, and the free rotor which serves as the electromechanical shield. Under steady state conditions, both rotate at a synchronous speed, but during a fault transient, the shield acts as a low-pass filter, protecting the field from the large pulsations in torque and magnetic field. The new machine is described, and its steady state and transient performance are outlined. (auth)

17071 MULTIPOLE SUPERCONDUCTING ELECTRIC MOTORS FOR SHIP PROPULSION. Thullen, P. (Massachusetts Inst. of Tech., Cambridge); Keim, T. A.; Minervini, J. V. IEEE Trans. Magn.; MAG-11: No. 2, 653-656(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

While a great deal of attention has been paid to two-pole superconducting synchronous machines, very little analysis of low speed, multipole superconducting synchronous machines has been done. Such machines may prove desirable as drive motors in ship drive systems. Results are presented of an analysis which assumes a motor of sufficient size that the airgap may be considered to be flat. A power output expression is given which shows the effects of machine geometry and superconductor characteristics on machine size. Based on this expression, a 40,000 hp 120 rpm motor is sized, and the resulting machine is compared with a conventional ship drive motor. The comparison illustrates possible size reductions through the application of superconductivity. (auth)

17072 SUPERCONDUCTING MAGNETIC SYSTEMS AND ELECTRICAL MACHINES. Glebov, I. A. (Inst. of Electrical Machinery, Leningrad). IEEE Trans. Magn.; MAG-11: No. 2, 657-660(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The use of superconductors for magnets and electrical machines attracts close attention of designers and scientists. A description is given of an ongoing research program to create superconductive magnetic systems, commutator motors, homopolar machines, topological generators and turbogenerators with superconductive field windings. All the machines are tentative experimental models and serve as a basis for further developments. (auth)

17073 MAGNETIC FIELD IN A SYSTEM WITH SUPERCONDUCTING SHIELDS. Shakhtarin, V. N.; Pylinia, S.N.; Rizhikov, M. A. (Ministry for Electrical Engineering Industries, Moscow). IEEE Trans. Magn.; MAG-11: No. 2, 661-666(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The problem of calculating the magnetic field in magnets with superconducting shields is considered. As an example, the magnetic field of a rectangular cross section coil with two shields is analyzed. The results are compared with experimental data. (auth)

17074 COHERENT EFFECTS IN SERIES ARRAYS OF PROXIMITY EFFECT SUPERCONDUCTING BRIDGES. Palmer, D. W.; Mercereau, J. E. (California Inst. of Tech., Pasadena). IEEE Trans. Magn.; MAG-11: No. 2, 667-670(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Planar series arrays of up to 500 proximity effect superconducting bridges were fabricated with sufficient uniformity to respond coherently to incident radiation (10–20,000 MHz) without separate biasing. By varying the geometry, resistance for the arrays can range from 0.1–50 OMEGA. Despite this high total impedance, low frequency coherent response to external radiation is limited only by single bridge voltage noise. Low frequency (30–500 MHz) coherent internal voltage oscillations of current biased arrays were detected and confirm that the oscillating voltage signal grows linearly in bridge number while the voltage noise increases only as the square root. An array of n elements responds to incident high frequency radiation in first approximation as though it were a simple Josephson junction but quantized in units of n(h/2e). Coincident operation to high frequency depends strongly on small (less than or equal to 1 mu) bridge separation. High resistance, coincident operation, and exponential dependence of critical current on temperature make these arrays good candidates for voltage standards, coherent, and bolometric radiation detectors, and cryogenic rf sources. (auth)

17075 OBSERVATION OF MICROWAVE SYNCHRONIZATION OF THIN FILM MICROBRIDGE ARRAYS. Jillie, D. W.; Lukens, J.; Kao, Y. H. (State Univ. of New York, Stony Brook). IEEE Trans. Magn.; MAG-11: No. 2, 671-673(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A report is given on the characteristics of thin film microbridge Josephson junctions fabricated using electron beam lithography, and the techniques used to fabricate these junctions, which are typically 0.3 mu square, are discussed. Extensive measurements were made on both individual junctions of tin and indium and on small arrays of these junctions. Synchronization of current biased series arrays by an applied microwave field was achieved. This synchronization appears as a zero differential resistance across the entire array at a voltage of MV/sub J/, where M is the number of elements in series and V/sub J/ is the Josephson voltage h nu/2e. A systematic variation with microbridge dimension of the microwave enhancement of the critical current was observed. (auth)

17076 COHERENT AC JOSEPHSON EFFECT IN A BULK GRANULAR SUPERCONDUCTING SYSTEM. Yu, M. L.; Saxena, A. M. (Brookhaven National Lab., Upton, NY). IEEE Trans. Magn.; MAG-11: No. 2, 674-677(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A three-dimensional close-packed array of Josephson junctions was successfully produced in the form of a bulk granular superconductor. The granular system is a tightly compressed solid of small, oxide coated tin particles in the thousand A range. The three-dimensional array of Josephson junctions thus formed showed coherent Josephson oscillations when external rf radiation was imposed. Rf induced constant voltage steps were observed on its I-V characteristics at voltages a few thousand times the Josephson voltage h nu/2e. The external rf radiation also induced stable dc voltages on unbiased bulk samples, suggesting a practical mode of microwave detection. The analogy of this bulk superconducting system with a magnetic spin system will be discussed. (auth)

17077 RADIATION DETECTION BY COHERENT JOSEPHSON: PHENOMENA IN AGGLOMERATED TIN FILMS. Ayer, W. J. Jr. (IBM, Essex Junction, VT); Rose, K. IEEE Trans. Magn.; MAG-11: No. 2, 678-680(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Radiant energy detection by superconducting thin films in both a thermal (or bolometer) mode and a current mode was previously reported. Additional evidence shows that at least some current-mode detection is due to Josephson behavior associated with agglomeration in tin films. The temperature dependence of the critical current agrees with results for Dayem bridges, and microwave-induced steps in the current-voltage characteristics are observed which have the proper dependence on frequency and power. At a constant film resistance, the current-mode responsivity shows structure (dips) in its dependence on bias current, which shifts with microwave frequency in agreement with the Josephson theory. The films appear to behave like an array of weak links in the correlated state. (auth)

17078 SUPERCONDUCTING NIOBIUM POWDER DETECTOR FOR SUBMILLIMETER RADIATION. Kovalenko, A. S.; Leshchenko, G. F. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). IEEE Trans. Magn.; MAG-11: No. 2, 681-682(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A report is given of an attempt to make a radiation detector for the submillimeter range using a superconducting niobium powder. The voltage across the detector was measured as a function of incident intensity at a fixed bias current. Sample fabrication is discussed, and the I–V and response characteristics of a typical detector are given. (PMA)

17079 OBSERVATIONS ON SMALL TUNNEL JUNCTION: ANOMALOUS CRITICAL-CURRENT TEMPERATURE DEPENDENCE, PERIODIC STRUCTURE, AND MICROWAVE DETECTION. Yeh, J. T. C.; Langenberg, D. N. (Univ. of Pennsylvania, Philadelphia). IEEE Trans. Magn.; MAG-11: No. 2, 683-686 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Observations on very small Pb–Pb oxide–Pb tunnel junctions prepared by a new method are reported. The zero-voltage Josephson critical current is found to increase, then decrease with decreasing temperature. The current-voltage characteristics show very prominent periodic structure. The junctions have microwave (X-band) power sensitivities of 10^{-14} W, more than two orders of magnitude better than conventional-size junctions. (auth)

17080 EFFECTS OF LASER IRRADIATION ON WEAK LINE DEVICES. Janik, R.; Morelli, L.; Cirillo, N. C. Jr.; Lechevet, J. N.; Gregory, W. D. (Georgetown Univ., Washington, DC). IEEE Trans. Magn.; MAG-11: No. 2, 687-689(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Experimental results are presented on the effects of optical radiation impinging on superconducting weak links and films. In-house fabricated weak links of various materials showed a lowering of critical current values dependent on radiation intensity. Also, specially modified commercial SQUIDS showed a lowering of both dc bias and rf bias required for SQUID operation as the optical intensity was increased. The possibilities of using high T/sub c/ materials for SQUID fabrication and the tuning of these devices via optical irradiation are discussed. (auth)

17081 MEASUREMENTS OF THE MAGNETIC FIELDS PRODUCED BY THE HUMAN HEART, BRAIN, AND LUNGS. Co-

hen, D. (Massachusetts Inst. of Tech., Cambridge). IEEE Trans. Magn.; MAG-11: No. 2, 694-700(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Magnetic fields produced by organs of the human body are being measured in a shielded room, using both a SQUID magnetometer and second-derivative gradiometer. Measurements of the field around the human body can yield new information not obtainable with surface electrodes about organs which generate current and about organs which contain foreign, ferromagnetic particles. Magnetocardiograms of normal and abnormal heart subjects are being analyzed and visually displayed in order to assess their information content. Magnetoencephalograms recorded from normal and abnormal brain subjects are also under analysis. Measurements were made of magnetite dust in the lung, with two potential medical applications: (1) the use of pure magnetite dust as a deliberately inhaled tracer (harmless) for pulmonary diagnosis; and (2) the assessment of the amount of asbestos accumulated in the lungs of heavily-exposed workers, since most asbestos (harmful) occurs with adhered magnetite. (auth)

17082 ADVANCED SUPERCONDUCTING GRADIOMETER/MAGNETOMETER ARRAYS AND A NOVEL SIGNAL PROCESSING TECHNIQUE. Wynn, W. M. (Naval Coastal Systems Lab., Panama City, FL); Frahm, C. P.; Carroll, P. J.; Clark, R. H.; Wellhoner, J.; Wynn, M. J. IEEE Trans. Magn.; MAG-11: No. 2, 701-707(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Recent developments in superconducting magnetic gradiometer technology have led to the construction of advanced ultrasensitive gradiometer/magnetometer arrays. Details of construction techniques and data showing operational capabilities are presented. The most recent of the gradiometer/magnetometer arrays simultaneously measures five independent spatial gradients of the magnetic field and three vector components of the magnetic field. The measured signals from this array are subjected to a novel signal processing technique which provides detailed information about the magnetic signal source. (auth)

17083 SUPERCONDUCTIVITY APPLIED TO GRAVIMETRY. Goodkind, J. M.; Warburton, R. J. (Univ. of California, San Diego, La Jolla). IEEE Trans. Magn.; MAG-11: No. 2, 708-711(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A gravimeter was developed which uses the levitation of a superconducting sphere by the field of persistent current magnets. Instabilities in the field were reduced to the point where environmental noise on local gravity is greater than the instrument noise. At presept, the persistent currents are decaying at a rate of 2 parts in 10^7/yr. Concurrent measurements of magnetic field and gravimeter signal allow for correction of this drift. The device is being applied to geophysical problems through measurements of: (1) secular variations in local gravity; (2) tides of the solid earth; (3) effects of oceans and atmosphere on local gravity; and (4) normal modes of the earth. (auth)

17084 SQUID READOUT SYSTEM FOR A SUPERCONDUCTING GYROSCOPE. Hendricks, J. B. (Univ. of Alabama, Huntsville). IEEE Trans. Magn.; MAG-11: No. 2, 712-715(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The design of a readout system for a superconducting gyroscope to be used in an orbiting gyroscope relativity experiment is discussed. The London moment of the superconducting rotor, which lies along the spin axis of the rotor, will be measured with a SQUID type magnetometer. The SQUID will be built around the gyro rotor, with a very close spacing to give an inductance between 10^{-8} and 10^{-9} Hy. A SQUID of this design should resolve 10^{-4} phi_0. The angular resolution of the gyroscope will then be DELTA THETA equals 3.5×10^{-3} arc-second, which is sufficient for the intended experiment. (auth)

17085 CRYOGENIC DIRECT CURRENT COMPARATORS AND THEIR APPLICATIONS. Dziuba, R. F. (National Bureau of Standards, Washington, DC); Sullivan, D. B. IEEE Trans. Magn.; MAG-11: No. 2, 716-719(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Cryogenic direct current comparators, utilizing superconducting shields and Superconducting Quantum Interference Devices (SQUIDS), provide current ratios of up to 100/1 or higher with accuracies of less than or equal to 1×10^{-9} and current resolutions of less than or equal to 6×10^{-11}A. Two types of comparators differing in the shielding arrangement of the ratio windings are described. One type consists of unit windings inside a seamless Pb tube; the other consists of multi-turn ratio windings within an overlapping toroidal superconducting shield. For both shielding configurations, SQUIDs serve as flux sensors for the comparators. The application of these comparators to the measurement of resistance ratios is described. (auth)

17086 APPLICATIONS OF A ZERO-FREQUENCY SUPERCONDUCTING INDUCTANCE BRIDGE. Meservey, R.; Tedrow, P. M.; Paraskevopoulos, D. (Massachusetts Inst. of Tech., Cambridge). IEEE Trans. Magn.; MAG-11: No. 2, 720-723 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

An inductance bridge was constructed which operates at zero frequency to compare superconducting inductors. The bridge uses a point contact SQUID as a current null detector. The unknown and standard inductors are at liquid helium temperature, but the bridge is balanced by resistance adjustments at room temperature. The present bridge can detect a change of 1 part in 10^4 in a mu H inductance and has various advantages over ac bridges. The bridge can be applied in a number of ways. Current usage is for determinations of the kinetic inductance, penetration depth, and critical current of thin film circuits. The bridge is particularly adapted to measuring the quantum phase difference vs current of current-dependent inductances. Susceptibility and precision measurements of inductance are other possible applications. Although the bridge was developed to measure small inductances, the principle can be easily applied to larger inductances and may be useful in large scale applications. (auth)

17087 RELIABLE DC SQUID MADE WITH TUNNEL JUNCTIONS. Clarke, J.; Goubau, W. M.; Ketchen, M. B. (Univ. of California, Berkeley). IEEE Trans. Magn.; MAG-11: No. 2, 724-727(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Dc SQUIDS of cylindrical geometry were fabricated using Nb-NbO/sub x/-Pb tunnel junctions. The SQUIDs can be thermally cycled repeatedly and cooled in the earth's magnetic field without significant loss of performance. Flux resolution of 3×10^{-5} phi_0/rootHz above a frequency of 1 Hz was achieved through optimization of electronic circuitry and careful shielding. Fluctuations and drift in the temperature of the helium bath are found to be the major source of long-term SQUID noise. With a simple temperature stabilizer, drift was reduced to less than 8×10^{-5} phi_0/hr over a three hour period. (auth)

17088 SUPERCONDUCTING MAGNETOMETER FOR HIGH RESOLUTION SUSCEPTIBILITY MEASUREMENTS. Cerdonio, M. (Univ. of Rome); Messana, C. IEEE Trans. Magn.; MAG-11: No. 2, 728-731(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A superconducting susceptometer operating in temperature range up to 230°K was developed. The instrument is capable of routine susceptibility measurements on frozen solutions and suspensions, powders, and crystals. A single helium fill-up lasts about 8 hours and allows about 50 susceptibility measurements at various sample temperatures. Sensitivity is 6×10^{-11} e.m.u./cc for a sample volume of 0.5 cc and is independent of temperature. The overall accuracy of the instrument for sample temperatures up to 230°K is 3×10^{-9} e.m.u./cc, temperature independent, in a typical applied field of 20 gauss. (auth)

17089 CURRENT-PHASE RELATIONS AND NOISE IN RF BIASED SQUIDS. Jackel, L. D.; Clark, T. D.; Buhrman, R. A. (Cornell Univ., Ithaca, NY). IEEE Trans. Magn.; MAG-11: No. 2, 732-735(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

An investigation was made of the effect of the weak link current-phase relation on noise in rf biased SQUIDs. Non-sinusoidal current-phase relations were observed in various weak links, and these non-sinusoidal relations were correlated with significantly increased intrinsic noise in the SQUID ring. The current-phase relation was also found to affect the amplitude of the rf SQUID ring dissipation. The result of an rf SQUID system noise analysis shows that, due to increased intrinsic noise and reduced ring dissipation, the minimum attainable noise for a SQUID ring having a very non-sinusoidal current-phase relation is considerably greater than for a ring with a sinusoidal relation. (auth)

17090 LOW NOISE: PERMANENTLY ADJUSTED UHF SQUID MAGNETOMETER. Clark, T. D.; Jackel, L. D. (Cornell Univ., Ithaca, NY). IEEE Trans. Magn.; MAG-11: No. 2, 736-738(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The development of a simple 450 MHz SQUID magnetometer, utilizing a symmetric two-hole permanently adjusted point contact

SQUID ring, is reported. One hole of the SQUID ring is coupled to the center conductor of a resonant superconducting coaxial cavity. A superconducting coil, inserted into the other hole, allows the coupling of an external flux into the SQUID system. The sensitivity is an order of magnitude better than that attained with identical SQUID rings biased at approximately 10 MHz. This improvement can be achieved simply and relatively inexpensively, and without sacrificing the excellent flux coupling attainable with such SQUID rings. (auth)

17091 FABRICATION AND PERFORMANCE OF NbN THIN FILM PLANAR SQUIDs. Fujita, T.; Kosaka, S.; Ohtsuka, T.; Onodera, Y. (Tohoku Univ., Sendai). IEEE Trans. Magn.; MAG-11: No. 2, 739-742(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Planar SQUIDs, with a Dayem bridge and two holes, were fabricated by sputter etching NbN thin films deposited epitaxially on MgO substrates, and their performance was tested in a conventional mode of operation at 15 MHz. The devices operate with satisfactory reliability, and their operating temperature covers a wide range, nearly from the superconducting transition temperature of the basic films (e.g. approximately 15 K) down to the pumped liquid helium temperature. The fabrication technique and the results of the performance test are presented, and the bridge characteristics and possible applications of the device are discussed. (auth)

17092 ASPECTS OF SUPERCONDUCTING QUANTUM INTERFEROMETER OPTIMIZATION. Vasiliev, V. V. (Joint Inst. for Nuclear Research, Dubna, USSR); Danilov, V. V.; Likharev, K. K. IEEE Trans. Magn.; MAG-11: No. 2, 743-748(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Magnetometers are employed to search for the electrical dipole moment of the electron in the macroscopic experiment, in low temperature paramagnetic thermometry and also to test the degree of magnetic field shielding with a hollow superconducting screen. Optimizing several adjustable parameters of a quantum superconducting fluxmeter and thus improving its characteristics provides for more effective use of it. Some basic aspects of optimization of the conventional single-junction fluxmeter characteristics are reported. A schematic of the fluxmeter and the main symbols are given. (auth)

17093 ASPECTS OF THE DYNAMICS OF JOSEPHSON JUNCTION CIRCUITS AND DEVICES. Fulton, T. A. (Bell Telephone Labs., Murray Hill, NJ). IEEE Trans. Magn.; MAG-11: No. 2, 749-750(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A descriptive review of some of the familiar and not-so-familiar behavior of Josephson devices is given making use of mechanical analogs. Previously unpublished material on the two-dimensional junction analog and noise properties of the resistively-shunted junction model is given here. (auth)

17094 STORAGE AND DETECTION OF A SINGLE FLUX QUANTUM IN JOSEPHSON JUNCTION DEVICES. Gueret, P. (IBM Zurich Research Lab.). IEEE Trans. Magn.; MAG-11: No. 2, 751-754(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

It is shown both by computer simulations and experimentally that a single Josephson junction has memory and can therefore be used for information storage. Means of reading-out the information content of such a memory element are demonstrated. Finally, memory operation, writing and reading, is described as a direct application of these concepts. (auth)

17095 1.4 MIL^2 MEMORY CELL WITH JOSEPHSON JUNCTIONS. Broom, R. F.; Jutzi, W.; Mohr, T. O. (IBM Zurich Research Lab.). IEEE Trans. Magn.; MAG-11: No. 2, 755-758(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

An integrated loop memory cell with miniaturized Josephson junction dimensions (approximately 5 x 5 mu m^2) and very high Josephson current density (30 kA/cm^2) was made in a 2 mu m minimum line width lead alloy. The storage currents are easily set up with coincident word and digit pulses. Nondestructive readout, write, and half selection was successfully performed. The deduced current transfer time during write is below 80 ps. (auth)

17096 CHARACTERISTICS OF IN-LINE JOSEPHSON TUNNELING GATES. Basavaiah, S. (IBM Thomas J. Watson Research Center, Yorktown Heights, NY); Broom, R. F. IEEE Trans. Magn.; MAG-11: No. 2, 759-762(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Characteristics of in-line Josephson gates were computed using numerical techniques for a number of differing junction length-to-Josephson penetration depth ratios. These are verified by systematic experimental results, the agreement between theory and experiment being good. (auth)

17097 BARRIER FORMATION IN LEAD-BASED TUNNEL JUNCTIONS STUDIED BY SURFACE TECHNIQUES. Emmanuel, A.; Donaldson, G. B.; Band, W. T.; Dew-Hughes, D. (Univ. of Lancaster, Eng.). IEEE Trans. Magn.; MAG-11: No. 2, 763-765 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A process is described for the production of Pb(In)–oxide barrier-Pb Josephson tunnel junctions. The junctions are predictable in resistance to within 30 percent, and have excellent leakage, storage, and aging properties. Critical currents and magnetic behavior agree well with theory. Investigation of the deposited films by surface techniques shows that the presence of In suppresses the formation of hillocks which occur during annealing and during sputter etching. The distribution of In through the films is investigated by ion scattering spectroscopy, which shows In enrichment at the free surface. There is some, as yet inconclusive, evidence that In plays an important role in the barrier formation (oxidation) process. (auth)

17098 SINGLE-CRYSTAL SILICON-BARRIER JOSEPHSON JUNCTIONS. Huang, C. L.; Van Duzer, T. (Univ. of California, Berkeley). IEEE Trans. Magn.; MAG-11: No. 2, 766-769(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

1250A-thick silicon-barrier Josephson junctions were made and tested. The junctions tested show supercurrent and have junction characteristics which may be useful for high-frequency applications. A detailed junction fabrication process and the effects of surface oxides on the junction characteristics are described. (auth)

17099 HIGH-SPEED SWITCHING AND LOGIC CIRCUITS USING JOSEPHSON DEVICES. Chan, H. W.; Lum, W. Y.; Van Duzer, T. (Univ. of California, Berkeley). IEEE Trans. Magn.; MAG-11: No. 2, 770-773(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The use of Josephson devices as switching components for computer circuits was investigated including a study of the switching properties of the superconductor-semiconductor-superconductor junction. The switching speeds of a single junction and a basic memory cell computed by numerical methods are comparable with the corresponding values for oxide-barrier junctions. Having a much lower Q than the conventional oxide-barrier junction, the junction should not show the previously experienced difficulties caused by junction resonances. The damping of plasma oscillations in the semiconductor junction is also more effective, leading to a shorter switching time. A new type of logic gate employing Josephson devices was investigated. This circuit would automatically unlatch after each operation, thus requiring no external means for resetting. Numerical analysis predicts subnanosecond switch-reset operation for appropriate parameter choices. The qualitative behavior of the circuit was also shown with a mechanical analog. (auth)

17100 APPLICATION OF INTEGRATED CIRCUIT TECHNOLOGY TO THE FABRICATION OF LARGE NUMBERS OF NIOBIUM BASED JOSEPHSON JUNCTIONS. Owen, S.; Nordman, J. E. (Univ. of Wisconsin, Madison). IEEE Trans. Magn.; MAG-11: No. 2, 774-777(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A batch fabrication technology is described for the production of small niobium based Josephson junctions. This technology uses thermally oxidized silicon wafers as substrates, allowing maximum usage of silicon integrated circuit techniques and equipment. Patterns are produced in rf sputtered niobium films by sputter etching through masks generated by "step and repeat" photolithographic techniques. Typically over 600 junctions are fabricated at one time. Measurements of voltampere curves, Josephson current versus magnetic field, and self resonant step structure were made. (auth)

17101 ADVANCES IN SUPERCONDUCTING QUANTUM ELECTRONIC MICROCIRCUIT FABRICATION. Kirschman, R. K. (Jet Propulsion Lab., Pasadena, CA); Notarys, H. A.; Mercereau, J. E. IEEE Trans. Magn.; MAG-11: No. 2, 778-781(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Standard microelectronic fabrication techniques were utilized to produce batch quantities of superconducting quantum electronic devices and circuits. The over-all goal is a fabrication technology yielding circuits that are rugged, stable, and capable of being fabricated controllably and reproducibly in sizeable quantities. Progress toward this goal is presented, with primary emphasis on the most recent work, which includes the use of electron-beam lithography and techniques of hybrid microelectronics. Several prototype microcircuits were successfully fabricated. These microcircuits are formed in a thin-film parent material consisting of layers of superconducting and normal metals, and use proximity effect structures as the active circuit elements. (auth)

17102 NIOBIUM MICROBRIDGES FOR SQUID APPLICATIONS. Holdeman, L. B.; Peters, P. N. (Space Science Lab., Marshall Space Flight Center, AL). IEEE Trans. Magn.; MAG-11: No. 2, 782-784(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Niobium microbridges developed for SQUID applications are discussed. Production is reliable for superconducting films down to a thickness of 50 Angstroms using rf bias sputtering techniques. Bridge patterns of submicron width are produced through electron lithography with a scanning electron microscope/flying spot scanner combination. The transition from macroscopic leads to the microbridge is made with a multiple exposure technique. The pattern is reproduced in the superconducting niobium films by sputter etching. (auth)

17103 PREPARATION OF SUPERCONDUCTING WEAK LINES IN MOLYBDENUM FILMS BY ION IMPLANTATION. Harris, E. P. (IBM Watson Research Center, Yorktown Heights, NY). IEEE Trans. Magn.; MAG-11: No. 2, 785-788(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Patterns of N^+ and/or S^+ ions were implanted into Mo films to produce structures in which two heavily doped Mo regions with relatively high transition temperature T/sub c/ are connected by a short (approximately 1 mu m) lightly-doped Mo region with lower transition temperature T'/sub c/. Near T'/sub c/ the lightly-doped region acts as a weak link between the heavily doped regions and passes a supercurrent having an oscillatory "diffraction pattern" dependence on magnetic field similar to that of Josephson tunnel junctions. (auth)

17104 PARAMETRIC AMPLIFICATION WITH SELF-PUMPED JOSEPHSON JUNCTIONS. Kanter, H. (Aerospace Corp., Los Angeles). IEEE Trans. Magn.; MAG-11: No. 2, 789-793(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The parametric nature of supercurrent in Josephson junctions may be exploited for amplification of high frequency signals in several modes of operation, where in each case the reactance variation is provided by the internal oscillations due to the average contact potential: (1) one mode, negative resistance amplification with a single idler, is entirely equivalent to that generally employed in conventional parametric amplifiers with varactor diodes; (2) negative resistance amplification with several idlers at further combination frequencies is typical for the resistively shunted junction model; and (3) amplification by upconversion is conceptually employed in the rf SQUID used in magnetometry. Experimental verifications of these various modes are described, and their suitability for low noise amplification discussed. The upconverter experiment permitted the measurement of device noise by variation of the temperature of the input termination, and an upper noise limit of 15°K was established. This experiment demonstrates that in high frequency application of active self-oscillating Josephson junctions, the fundamental noise achievable is not greatly in excess of the thermal limit. (auth)

17105 SUPERCONDUCTING LOW NOISE RECEIVERS. Silver, A. H. (Aerospace Corp., Los Angeles). IEEE Trans. Magn.; MAG-11: No. 2, 794-797(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

It is now possible to develop a new class of receivers for the millimeter and shorter wavelength region by application of Josephson and other electron tunneling phenomena which occur in superconducting materials. This development represents a major advance in receiver sensitivity and will be applicable over a wide frequency interval. Operating in the conventional heterodyne detection mode, a receiver has a theoretical noise temperature as low as 20 K at 100 GHz. Three basic components required are: (1) a superconductor-semiconductor Schottky diode mixer; (2) a Josephson junction phase-locked multiplier local oscillator; and (3) a Josephson parametric amplifier. The component and system design and limiting factors are discussed. (auth)

17106 NOISE IN JOSEPHSON MM-WAVE MIXERS. Claassen, J. H.; Taur, Y.; Richards, P. L. (Univ. of California, Berkeley). IEEE Trans. Magn.; MAG-11: No. 2, 798-799(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Point contact Josephson junctions can function as millimeter wave heterodyne mixers with conversion gain. The best results achieved thus far show a single sideband conversion gain of 1.3 and a mixer contribution to the system noise temperature of 54°K. Both of these results are approximately 5 times better than the best published figures for cooled Schottky barrier diode mixers operated at the same frequency. The measured noise for a variety of junctions can be expressed as a universal function of the normalized rf frequency OMEGA equals h omega/2eI/sub c/R. It is about a factor 2 larger than the calculated noise arising from the thermal noise in the junction shunt resistance, R. The noise calculation was done for the resistively shunted junction model using an analog junction simulator. (auth)

17107 POWER SPECTRUM OF AN INJECTION-LOCKED JOSEPHSON OSCILLATOR. Stancampiano, C. V.; Shapiro, S. (Univ. of Rochester, NY). IEEE Trans. Magn.; MAG-11: No. 2, 800-803(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Experiments have shown that a Josephson oscillator, exposed to a weak narrow-band input signal, exhibits behavior characteristic of an injection-locked oscillator. When in lock, Adler's theory of injection locking describes the experimental observations reasonably well. The range of applicability of the theory is extended to the out-of-lock regime, where a spectrum of output frequencies is observed. Obtaining the theoretical output power spectrum requires solving a differential equation having the same form as the equation describing the resistively shunted junction model of Stewart and of McCumber. Experimental measurements of the output spectrum of a nearly locked Josephson oscillator are shown to be in reasonable agreement with the theory. Additional results discussed briefly include the observation of a frequency dependence of the locked Josephson oscillator output and experiments in which a Josephson oscillator-mixer was injection locked by a weak signal at the if. (auth)

17108 SELF-SYNCHRONOUS PARAMETRIC AMPLIFIC..TION USING JOSEPHSON JUNCTIONS. Yu, M. L. (Brookhaven National Lab., Upton, NY). IEEE Trans. Magn.; MAG-11: No. 2, 804-806(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A new way to use Josephson junctions for parametric amplification with phase control is proposed. The dc current bias of the junction is adjusted such that the Josephson oscillation automatically synchronizes with the input signal and oscillates at twice the signal frequency with the proper relative phase. The impedance of the junction then has a negative resistive component which can be used for amplification. Extension to other phase sensitive circuits is also discussed. (auth)

17109 PERTURBATION TREATMENT OF MIXING IN JOSEPHSON JUNCTIONS. Levinsen, M. T.; Ulrich, B. T. (Univ. of Texas, Austin). IEEE Trans. Magn.; MAG-11: No. 2, 807-810 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A current biased, resistively shunted Josephson Junction irradiated at two frequencies is considered. The perturbation technique introduced by Aslamasov and Larkin is used in the calculations, and both signals are treated as perturbations. The second order calculation yields the size of the mixing steps at V/sub +-/ equals h(omega$_1$ +- omega$_2$)/2e. As in the case of a single frequency, subharmonic mixing steps are absent. The amplitude of the voltage oscillation at the difference and sum frequencies is shown to be non-zero at all voltages. The microwave resistance is calculated for one frequency omega$_2$ to third order in the perturbation. There are negative resistance regions near V/sub +-/ (as well as near V_2 equals h omega$_2$/2e). Near V/sub -/, the negative resistance region appears for bias voltage V just above V/sub -/, while near V the region appears for V just below V/sub +/. This means that when an incident frequency mixes with a cavity mode, the mixing step at V/sub -/ will be inverted compared to the cavity step itself. (auth)

17110 ENERGY STORAGE AND SUBHARMONIC OSCILLATIONS IN JOSEPHSON JUNCTIONS. Dempsey, D. G.; Levinsen, M. T.; Ulrich, B. T. (Univ. of Texas, Austin). IEEE Trans. Magn.; MAG-11: No. 2, 811-814(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The energy stored in the magnetic and electric field near a superconducting point contact is typically the same magnitude as the coupling energy which produces the Josephson effect in the weakly coupled superconductors. These energies are usually on the order of one electron volt. One consequence of energy storage in both the electric and the magnetic field is that the junction can oscillate at a fundamental frequency omega equals 2 eV/hn, where n is an integer. The dynamics of these subharmonic oscillations were studied for a model in which the magnetic and electric energies are represented as being stored in an inductance and a capacitance respectively. The model was studied numerically for various biasing conditions, and the behavior was compared to experimental data. A simple analytic approximation was developed that gives physical insight into the mechanism that creates the subharmonic oscillations. The electrical analog model demonstrated that these subharmonic oscillations can phase lock with an externally applied signal. (auth)

17111 ELECTRODYNAMIC APPROACH TO STUDYING PROCESSES IN SYSTEMS WITH WEAKLY COUPLED SUPERCONDUCTORS. Bystrov, V. A.; Dmitriev, V. M.; Pavlyuk, V. A.; Sherstyuk, N. I.; Tretyakov, O. A. (Physical-Technical Inst. of Low Temperatures, Kharkov). IEEE Trans. Magn.; MAG-11: No. 2, 815-816(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Using the Josephson effect in radio schemes whose component sizes are of about the operating wavelength requires rigorous methods for studying wave processes in weakly coupled superconductors. The analysis of electromagnetic fields in such schemes assists in understanding their electrodynamics and in getting information necessary for instrument design. An electrodynamic approach is proposed for studying wave phenomena in cryogenic quantum units in the microwave range, in which waveguide-matched Josephson junctions operate in continuous and impulse regimes. (auth)

17112 DESIGN OF STABLE THIN-FILM JOSEPHSON TUNNEL JUNCTIONS FOR THE MAINTENANCE OF VOLTAGE STANDARDS. Pech, T.; Saint-Michel, J. (LCIE and LGEP, Fontenay-aux-Roses, France). IEEE Trans. Magn.; MAG-11: No. 2, 817-820(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The behavior of Josephson tunnel junctions was theoretically investigated in order to determine the junction preparation parameters which allow one to obtain a junction, which, when subjected to microwave radiation, produces a convenient constant-voltage current step structure at high bias voltages. Major junction characteristics (geometrical dimensions, normal tunnel resistance R/sub N/, and critical current I_0, for example) are taken into account, as well as various coupling conditions between junction and microwave radiation. Stable Nb–oxide–Pb junctions having various electrical characteristics for rather different geometrical dimensions were prepared and tested. The experimental results are in good agreement with our calculations. (auth)

17113 COUPLING BETWEEN JOSEPHSON JUNCTIONS AND MICROSTRIPLINES. Finnegan, T. F.; Wilson, J.; Toots, J. (National Bureau of Standards, Washington, DC). IEEE Trans. Magn.; MAG-11: No. 2, 821-824(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A promising method for microwave coupling to thin-film Josephson devices via microstripline techniques was developed which has significant advantages over more traditional waveguide techniques. In particular, direct determination of intrinsic junction cavity parameters such as the geometrical resonance frequencies and Q values are made practical, and compact cryogenic multi-octave microwave holders are readily realized. The results of coupling experiments with Pb–Pb oxide–Pb and Nb–Nb oxide–Pb tunnel junctions are discussed, and applications of these results to the design and construction of shielded single junction 2e/h devices and small multi-junction arrays are described. (auth)

17114 INFLUENCE OF AN EXTERNAL RADIATION ON A JOSEPHSON OSCILLATOR AND PHASE LOCKING EFFECTS. Vernet, G.; Adde, R. (Paris Univ., Orsay, France). IEEE Trans. Magn.; MAG-11: No. 2, 825-828(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The frequency conversion signal of a Josephson junction operating as an oscillator mixer is not observable when the intermediate frequency is too low. To test experimentally the possibility of phase-locking effects, a superconducting point contact oscillating at f_0 approximately 9 GHz is irradiated with an external radiation of frequency f_1 between 8 and 18 GHz. The Josephson oscillation level and linewidth are measured as a function of the power level of the external signal at f_1 with delta f equals parallel $f_0 - f_1$ parallel as a parameter. With large delta f values, the variations of the Josephson oscillation and linewidth are the consequence of the V-I characteristic modification. With low delta f, the operating point in the VIC is in the induced step curvature, and the observed variations show that progressive phase locking occurs. (auth)

17115 EXPERIMENTAL INVESTIGATION OF PARAMETRIC EXCITATION OF PLASMA OSCILLATIONS IN JOSEPHSON TUNNEL JUNCTIONS. Bak, C. K.; Kofoed, B.; Pedersen, N. F.; Saermark, K. (Technical Univ. of Denmark, Lyngby). IEEE Trans. Magn.; MAG-11: No. 2, 829-833(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Experimental evidence for subharmonic, parametric excitation of plasma oscillations in Josephson tunnel junctions is presented. The experiments described are performed by measuring the microwave power necessary to switch a Josephson tunnel junction biased in the zero voltage state to a finite voltage state. (auth)

17116 NON-JOSEPHSON RADIATION FROM THE CAVITY CONTAINING A SUPERCONDUCTING POINT CONTACT JUNCTION. Vystavkin, A. N. (Inst. of Radio Engineering and Electronics, Moscow); Gubankov, V. N.; Kuzmin, L. S.; Likharev, K. K.; Migulin, V. V.; Semenov, V. K. IEEE Trans. Magn.; MAG-11: No. 2, 834-837(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Results of experimental investigation of "non-Josephson" radiation from the X-band cavity containing a Nb–Nb superconducting point contact junction are discussed. The experimental dependences of the amplitude and frequency of "non-Josephson" oscillations on the bias voltage across the junction and the modifications of the I–V characteristic (IVC) of the junction under action of these oscillations are presented. A comparison of the results with theoretical calculations is made. It is shown that the influence of fluctuations on phenomenon characteristics is considerable. (auth)

17117 MILLIMETER WAVEBAND SIGNAL CONVERSION IN S-c-S JOSEPHSON JUNCTIONS WITH SELF-PUMPING. Avakjan, R. S. (Inst. of Radio Engineering and Electronics, Moscow); Vystavkin, A. N.; Gubankov, V. N.; Migulin, V. V.; Shtykov, V. D. IEEE Trans. Magn.; MAG-11: No. 2, 838-841(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The temperature sensitivity of a radiometer with a Josephson junction mixer at the input was experimentally determined to be better than that of existing radiometers with Shottky diode mixers in the short millimeter waveband range, but worse by 10 to 15 db than follows from the theory. The temperature sensitivity can be reduced by approximately an order of magnitude by optimization of the amplifier parameters and by shunting the junction with a "cold" resistance. (auth)

17118 LOW FREQUENCY NOISE IN JOSEPHSON JUNCTIONS. Clarke, J.; Hawkins, G. (Univ. of California, Berkeley). IEEE Trans. Magn.; MAG-11: No. 2, 841-844(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Using a high resolution SQUID voltmeter, measurements were made of the spectrum of low frequency voltage fluctuations across a thin-film Josephson tunnel junction biased at a constant current I greater than the junction critical current I/sub c/. The frequency dependence of the voltage spectrum $V^2(f)$ may be accurately represented by the power law $V^2(f)$ varies as f^{-1} over the frequency range of the data: 10^{-2} less than f less than 10 Hz. The dependence of the magnitude of the spectra at any single frequency upon the value of the bias current I and upon the sample temperature T supports the hypothesis that the observed voltage fluctuations arise from a modulation of the junction critical current I/sub c/ by equilibrium, thermodynamic temperature fluctuations in the active junction volume. The measurements were interpreted in terms of the semi-empirical theory of Clarke and Voss for the low frequency fluctuation spectrum of systems obeying a diffusion equation. This interpretation provides design criteria which may prove useful in reducing the level of long-term drifts in systems employing Josephson tunnel junctions. (auth)

17119 LOW FREQUENCY NOISE IN SUPERCONDUCTING Sn FILMS AT THE TRANSITION TEMPERATURE. Clarke, J.; Hsiang, T. Y. (Univ. of California, Berkeley). IEEE Trans. Magn.; MAG-11: No. 2, 845-847(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The noise power spectrum was measured for tin films evaporated on glass substrates biased at the transition temperature. The spectrum is close to 1/f between 0.1 and 1000 Hz. The noise

is found to be correlated over a correlation length (D/pi f)/sup ½/, where D is the diffusivity of tin film. Studies were also made of samples in which a thin layer of aluminum was predeposited before tin evaporation. The aluminum layer appears to greatly reduce the thermal boundary resistance between tin and the substrate. The amplitude of noise for such samples is greatly reduced below 10 Hz, where it is almost independent of frequency. These results are in accord with the thermal diffusion theory proposed by Clarke and Voss and should have important implications on future construction of superconducting bolometers. (auth)

17120 NOISE MEASUREMENTS ON PROXIMITY EFFECT BRIDGES. Decker, S. K.; Mercereau, J. E. (California Inst. of Tech., Pasadena). IEEE Trans. Magn.; MAG-11: No. 2, 848-851 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Audio frequency noise density measurements were performed on weakly superconducting proximity effect bridges using a cooled transformer and room temperature low noise preamplifier. The noise temperature of the measuring system is approximately 4^0K for a 0.9 OMEGA resistor. Noise density was measured as a function of bias current and temperature for the bridges. Excess noise above that expected from Johnson noise for a resistor equal to the dynamic resistance of the bridges was observed in the region near the critical current of the device. At high currents compared to the critical current, the noise density closely approaches that given by Johnson noise. (auth)

17121 PHASE SLIP, DISSIPATION, BERNOULLI EFFECT, PARAMETRIC CAPACITANCE, AND OTHER CURIOUS FEATURES OF THE JOSEPHSON EFFECTS. Zimmerman, J. E. (National Bureau of Standards, Boulder, CO). IEEE Trans. Magn.; MAG-11: No. 2, 852-855(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The details of the Josephson effect in thin metal bridges are difficult to derive quantitatively, and many papers have been written on the subject attempting to describe quantitatively such qualitative features as irreversible phase slip, instantaneous 2 pi phase slip, variation of order parameter in time and space, Bernoulli effect, and others. It does not seem to be generally recognized that all of these qualitative features are universal attributes of the Josephson effect and occur also in tunnel junctions. In addition, when a steady voltage is impressed across a junction, a term in the electric field is set up (in addition to the Bernoulli field) which has a rather complex temporal and spatial variation. (auth)

17122 COMMENTS ON THE ROLES OF THE COSINE TERM AND THE REACTIVE PART OF THE QUASIPARTICLE TERM IN THE JOSEPHSON TUNNELING CURRENT. Harris, R. E. (United Aircraft Research Labs., East Hartford, CT). IEEE Trans. Magn.; MAG-11: No. 2, 856-857(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A short summary of the theory of Josephson tunneling in the presence of a time-dependent voltage is given. It is shown that neither the reactive part of the quasiparticle current nor the cosine term contributes directly to the time-averaged current. However, non-zero frequency components of these two terms can interact with a circuit in such a way as to alter the voltage and therefore the time-averaged current arising from the quasiparticle and sine terms. The importance of the reactive part of the quasiparticle and cosine terms is considered briefly at high frequencies. (auth)

17123 EXTENSION OF THE OPERATING RANGE OF SUPERCONDUCTING MICROBRIDGES. Klapwijk, T. M.; Mooij, J. E. (Technische Hogeschool, Delft, Netherlands). IEEE Trans. Magn.; MAG-11: No. 2, 858-859(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The self-heating of microbridges was reduced by attaching the actual thin (0.1 mu m) bridge to a thick (1 mu m) film. Two different fabricating procedures were followed, based on scratching with a diamond point. Contrary to expectation based on previous experimental evidence, Sn microbridges as long as 0.7 mu m and 1 mu m wide were found to show microwave (9 and 35 GHz) induced steps, periodically varying with power, in a temperature interval 0.3 less than T/T/sub c/ less than 0.97. Good results were also obtained with Al. These results support the idea that previous experiments have been considerably influenced by self-heating which was not taken into account in the interpretation of the results, and that it is possible to use microbridges for device applications at temperatures far below T/sub c/. (auth)

17124 DYNAMIC PROPERTIES OF VARIABLE THICKNESS BRIDGES. Likharev, K. K.; Yakobson, L. A. (Moscow State Univ.). IEEE Trans. Magn.; MAG-11: No. 2, 860-865(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The time dependent behavior of variable thickness bridges (VTB) was investigated, and expressions for the excess current, the root cos phi term, and the upper frequency boundary of the Josephson effect are given. The validity of the results obtained for different weak links (cross-scribed bridges, proximity effect bridges, and whiskers) is discussed. On the basis of a previous analysis, the properties of a memory element QUANTRON are studied. The properties of many-terminal bridges allow a combination of high parameters of an externally-pumped down-converter with the simplicity of a self-pumped down-converter. (auth)

17125 HIGH IMPEDANCE POINT CONTACT JOSEPHSON JUNCTIONS. Tolner, H.; Andriesse, C. C. IEEE Trans. Magn.; MAG-11: No. 2, 866-869(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A description is given of point contact junctions with normal state resistances of 10 OMEGA to 10 k OMEGA, made from electropolished Nb parts, which couple well to millimeter radiation. The response is governed by fluctuations, and the principal effect of external radiation is a change in the dynamic resistance. An approximate expression is given for the differential resistance at zero current, based on a linear combination of the effect of fluctuations and microwave radiation. Experimental data show significant deviations from the RSJ model. The results are in qualitative agreement with numerical calculations by Kalashnik et al. It is suggested that, for these junctions, zero-point fluctuations are dominant and are caused by the very small capacitance of about 10^{-15}F. (auth)

17126 OBSERVATION OF SINE MODULATED BESSEL BEHAVIOR IN MICROWAVE BIASED SQUIDs. Rachford, F. J. (Case-Western Univ., Cleveland); Huang, C. Y.; Nisenoff, M.; Wolf, S. A. IEEE Trans. Magn.; MAG-11: No. 2, 870-872(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The amplitudes of the signal lobes (Bessel Maxima) observed in several types of thin film SQUIDs excited at 9.2 GHz exhibit pronounced periodic intensity modulation. This behavior is consistent with the simplified flux entry model proposed by Mercereau in the limit of tau approximately T, where T is the shortest time between successive flux entry into loop and tau is the flux passage time. From the results, tau was deduced to be approximately 10^{12} seconds for both proximity effect and narrow constriction devices. (auth)

17127 DETAILED MEASUREMENTS OF THE RESPONSE OF AN rf SQUID IN THE REGIME LI/sub c/ less than PHI$_0$/2 pi. Rifkin, R. (Univ. of Virginia, Charlottesville); Vincent, D. A.; Hansma, P. K.; Deaver, B. S. Jr. IEEE Trans. Magn.; MAG-11: No. 2, 873-876(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A superconducting ring containing a Nb point contact inductively coupled to a resonant circuit fed with an rf current source (typical rf SQUID configuration) was used to measure the tank voltage as a function of frequency in the regime LI/sub c/ less than PHI$_0$/2 pi. For LI/sub c/ much less than PHI$_0$/2 pi, the curves of tank voltage versus drive current for various values of external flux PHI/sub x/ through the ring agree with the calculations of Hansma. For higher critical currents, there is an asymmetry in these curves for frequencies above and below omega$_0$, the resonant frequency of the circuit. Calculations using an expanded theory including the effects of a conductance G$_0$(1 + alpha cos phi) and of screening flux give good agreement with the data. In principle, alpha can be determined from these measurements, but the cos phi term and the screening flux produce qualitatively similar effects. A quantitative determination of alpha requires a precise knowledge of G$_0$/I/sub c/. Using values of G$_0$ and I/sub c/ from independent impedance measurements, the data yield a negative value of alpha, in agreement with another experiment. (auth)

17128 ENHANCEMENT OF THE CRITICAL CURRENT OF SUPERCONDUCTING BRIDGES BY MICROWAVE RADIATION. Latyshev, Yu. I.; Nad, F. Ya. (Inst. of Radioengineering and Electronics, Moscow). IEEE Trans. Magn.; MAG-11: No. 2, 877-879(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

An experimental investigation was made of the enhancement of the critical current of bridges in frequency range 8 to 78 GHz at

different temperatures. The results show that the range of the existence of this effect has both low frequency and high frequency limits. Measurements were made of the dependence of the critical current on the incident radiation power (fixed frequency) at different temperatures. For a frequency of 53.5 GHz, at the temperatures T less than 3.804°K, the critical current increases with the radiation power, passes through the maximum, and abruptly falls to zero. (auth)

17129 OBSERVATION OF THE JOSEPHSON EFFECT IN Nb_3Ge DAYEM BRIDGES. Janocko, M. A.; Gavaler, J. R.; Jones, C. K. (Westinghouse Research Labs., Pittsburgh). IEEE Trans. Magn.; MAG-11: No. 2, 880-882(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Dayem bridge Josephson junctions were successfully fabricated for the first time from sputtered thin films of high-T/sub c/ Nb_3Ge. Microwave induced current steps were observed in the I-V characteristic of one of these junctions at a frequency of 10 GHz at temperatures between 20.9 and 21.0°K. This junction was fabricated by a mechanical scribing technique, instead of sputter etching. Sputter etched junctions also exhibited Josephson steps, but only at much lower temperatures, due to a depression of T/sub c/ by the sputter etching process. (auth)

17130 FABRICATION AND JOSEPHSON PROPERTIES OF Nb_3Ge. Laibowitz, R. B. (IBM Zurich Lab.); Tsuei, C. C.; Cuomo, J. C.; Ziegler, J. F.; Hatzakis, M. IEEE Trans. Magn.; MAG-11: No. 2, 883-884(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Sputtering techniques were used to fabricate Nb_3Ge films on amorphous substrates which exhibit superconductivity up to about 21°K. Of the many sputtering parameters that can be varied, the most important appear to be target geometry, target composition, and substrate temperature. Initial results of composition analysis indicate that a Ge-rich phase nucleates during the initial stages of the deposition. Josephson microbridges were fabricated from these films, and microwave-induced steps in the I-V curves were observed in micron-sized bridges. An interpretation of the criticality of the bridge size in terms of a vortex state is given. (auth)

17131 ALEC, CONCEPTION AND CONSTRUCTION OF PULSED SUPERCONDUCTING DIPOLE. Boisslier, R.; Ferry, J.; Bronca, G.; Perot, J.; Dubois, P.; Maldy, J. Entropie; 10: No. 56, 14-22(1974). (In French)

The paper describes the conception and construction of magnets working with a pulsating rate using multi-filament superconducting materials. The coil and magnetic circuit, the choice of conductor and the cryostat and the protection of the magnet are described. (Electr. Electron. Abstr.)

17132 COOLING OF LARGE MASSES DOWN TO THE TEMPERATURE OF LIQUID HELIUM I. Plechac, L. (Vyzkummy Ustav Silnoproude Eledtrotech., Bechovice, Czech.). Elektrotech. Obz.; 63: No. 11, 666-670(Nov 1974). (In Czech)

The cooling of large masses (equipment with superconductors) down to the temperature of liquid helium is discussed. The individual objectives of a mathematical pursuit of this process are outlined. Discussed are the consumption of cryogenic liquids and the heat transfer from heat-exchanging surfaces into boiling helium and its vapours. (Electr. Electron. Abstr.)

17133 EXCITING ADVANCES IN SUPERCONDUCTING MAGNETIC TECHNOLOGY. Narliker, A. V. (National Physical Lab., New Delhi). Electr. India; 14: No. 12, 5-22(30 Jun 1974).

The state of art of the technology of superconducting magnets relating to the major advances in their design and performance is reviewed. Some of the large scale applications of superconducting magnets are discussed, e.g., MHD generation, fusion research, cryo-electron microscopy, boosting train speed, and superconducting motors and generators. Some future development trends are outlined. (Electr. Electron. Abstr.)

Heat Transfer and Fluid Flow

Refer also to abstracts 19402, 19454, and 19553.

17134 (AED-CONF-75-179-004) ADAPTATION OF EDDY CURRENT METHODS TO THE MULTIPLE PROBLEMS OF REACTOR TESTING. Stumm, W. 1975. 12p. (In German). INIS.

From lecture meeting of the Deutsche Gesellschaft fuer Zerstoerungsfreie Pruefverfahren; Berlin, F. R. Germany (6 May 1975).

In reactor testing, the eddy current method is mainly used for the testing of surface regions inside the pressure vessel, on welds and joints, and for the testing of thin-walled pipes, e.g., the heat exchanger pipes. (DE)

17135 HEAT EXCHANGE DURING PHASE INTERACTION IN RISING TWISTING FLOW. Chekhol'skii, S. L.; Chekhol'skii, A. S. (Belorussian Technological Inst., Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 2, 100-104(1974). (In Russian).

Results are given of an investigation into interphase heat transfer in two-phase upward twisted flow, carried out in a film flow regime in short tubes. An equation that satisfactorily generalizes the experimental data was obtained. (auth)

17136 HEAT TRANSFER DURING LAMINAR FLOW OF THE CHEMICALLY REACTING GAS NO_2 IN TRIANGULAR RODS. Nesterenko, V. B.; Tverkovkin, B. E.; Shegidevich, L. N.; Yakushev, A. P. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 3, 112-118(1974). (In Russian).

The problem of heat and mass transfer in triangular rod bundles with longitudinal laminar flow of chemically reacting NO_2 is considered. The finite rate of chemical reaction is taken into account. Temperature and concentration profiles were found by means of numerical solution of the governing equations with variable direction method. This problem was solved for pitch-to-diameter ratio 1:1 and uniform peripheral heat flux. The inlet region was also studied. The effect of chemical reaction on the surface rod temperature is shown. (auth)

17137 HEAT TRANSFER DURING MOVEMENT OF VAPOR-LIQUID CURRENTS OF NITROGEN TETRAOXIDE IN VERTICAL TUBES. Kolykhan, L. I.; Sen'ko, A. S. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 2, 76-80(1974). (In Russian).

The results of generalized experimental data concerning heat exchange in upward flow of nitrogen tetroxide in a two-phase state under heating conditions in vertical tubes are given. (auth)

17138 HEAT PIPES. Dunn, P.; Reay, D. A. Oxford; Pergamon Press Ltd. (1976). 303p. $18.00.

The history, theory, design, fabrication, performance, and uses of heat pipes are presented. Eight appendices on related material such as working fluid properties, heat pipe manufacturers, heat pipe patents etc. are provided. (LCL)

17139 FORCED VIBRATIONS OF A SHELL INSIDE A NARROW WATER ANNULUS. Bowers, G.; Horvay, G. (Massachusetts Univ., Amherst (USA)). Nucl. Eng. Des.; 34: No. 2, 221-231(Nov 1975).

The response of a shell to pulsating pressure in a narrow water-filled annulus is determined. The analysis is patterned after Penzes, according to which the imposed pump pressure over a portion of the outer periphery of the water annulus is replaced by an equivalent body force of appropriate thickness. While the amplitude of the response is smaller than that obtained by Penzes by a factor of about 8, the mode shapes agree closely with his results. (NL)

17140 STUDIES OF LIQUID FILM FLOW IN TWO-PHASE ANNULAR AND ANNULAR MIST FLOW REGIONS. I. Downflow in a Vertical Tube. Ueda, T.; Tanaka, T. Bull. JSME (Jpn. Soc. Mech. Eng.); 17: No. 107, 603-613(May 1974).

Analytical expressions are derived for the pressure gradient, wall-shear stress and interfacial-shear stress for the title conditions. Experiments were done with atmospheric air and water in a 28.8 mm dia. tube. A liquid film was injected on the wall through a porous sinter. Liquid hold-up was measured by shutting off the supply and simultaneously collecting the discharge from the test section. Mean liquid-film thickness was inferred from these measurements. Contact probes were used to study the liquid-film thickness and the film-surface condition. The distribution of liquid entrainment in the core was examined with a 1.6 mm dia. isokinetic probe. This indicated that a fixed sampling pipe of 18.2 mm dia. could be used to collect the core entrainment. A disk placed just downstream of the same sampling pipe was used to measure the core momentum flux. Heat transfer at the wall was also measured, using electrical heat input to the wall. Experimental results are presented for the liquid-film thickness and surface wave frequency; entrained droplet flow-rate distribution across the pipe, total entrainment flow rate, and core momentum flux change through the test section. Interfacial-shear stress inferred from these measurements is also presented. (Appl. Mech. Rev.)

17141 STUDIES OF LIQUID FILM FLOW IN TWO-PHASE ANNULAR AND ANNULAR-MIST FLOW REGIONS. II. Upflow in a Vertical Tube. Ueda, T.; Nose, S. Bull. JSME (Jpn. Soc. Mech. Eng.); 17: No. 107, 614-624(May 1974).

The experiment described in Part 1 was repeated almost identically for vertical upflow. Comparisons are made between upflow and downflow. In particular, while the thickness of the continuous sublayer of the film was approximately the same in the two cases, the thickness of the wavy layer was generally greater in upflow. Also, the flow rate of entrained droplets is approximately 1.5 times higher in upflow than in downflow. (Appl. Mech. Rev.)

17142 INVESTIGATION OF ADIABATIC OUTFLOW OF SATURATED AND SUBCOOLED WATER THROUGH CYLINDRICAL CHANNELS HAVING SHARP-EDGED INLETS. Alyoshin, V. S.; Kalaida, Yu. A.; Fisenko, V. V. At. Energ. (USSR); 38: No. 6, 375-378(Jun 1975). (In Russian)

This paper reports results of experimental investigations on the discharge of saturated and subcooled water through 5 and 9.53-mm diameter cylindrical channels having sharp-edged inlets with a ratio of 1/d of 0.5 to 18.0 for a pressure variation before the outflow channel of 25 to 150 atm, and water subcooled below saturation from 0 to 100°C. Experimental data obtained provide information on the effect of various factors on the mass flow rate. Critical regimes of flow of boiling water in the channels were investigated. Pressure and temperature profiles in the test channels are given. Calculated dependence for estimating mass flow rates of water discharging from long and short tubes are given. (auth)

17143 EFFECT OF ORIENTING THE HOT SURFACE WITH RESPECT TO THE GRAVITATIONAL FIELD ON THE CRITICAL NUCLEATE BOILING OF A LIQUID. Vishnev, I. P. J. Eng. Phys. (USSR) (Engl. Transl.); 24: No. 1, 43-48(Nov 1974).

Translated from Inzh.-Fiz. Zh.; 24: No. 1, 59-66(Jan 1973).

Laws are established according to which the critical boiling mode changes with the orientation of the hot surface. The existence of an extremum temperature is shown. Formulas are proposed which account for the surface orientation during boiling in a free volume. (Appl. Mech. Rev.)

17144 PRESSURE DROP DURING STEAM/WATER FLOW THROUGH ORIFICES. Chisholm, D.; Rooney, D. H. J. Mech. Eng. Sci.; 16: No. 5, 353-355(Oct 1974).

A method derived earlier for the prediction of pressure drop during steam/water flow through sharp-edged orifices requires the knowledge of the ratio of the gas to liquid velocities. This short note suggests a procedure to estimate this ratio for two different levels of dryness fractions of the steam-water mixture below and above 0.1. Experimental data are given to support the proposed method of calculation for the dryness fractions below 0.1. (Appl. Mech. Rev.)

17145 TWO-PHASE ANNULAR FLOW STREAM DIVISION IN A SIMPLE TEE. Fouda, A. E.; Rhodes, E. Trans. Inst. Chem. Eng. (London); 52: No. 4, 354-360(Oct 1974).

Careful experiments were conducted to determine the manner in which a two-phase annular flow divides in a simple horizontal tee. In an attempt to maintain the same quality in all branches of the fitting, baffles—with or without an orifice—were installed. It was found that the more successful, and simpler to fabricate, scheme was a simple orifice upstream of the tee. From an analytical standpoint, a separated-flow model proved to be most successful. (Appl. Mech. Rev.)

17146 EXPERIMENTAL INVESTIGATION OF HORIZONTAL TWO-PHASE FLOW BY AN ELECTRODIFFUSION METHOD. Krokovnyi, P. M. J. Appl. Mech. Tech. Phys.; 14: No. 2, 230-236(Dec 1974).

Translated from Zh. Prik. Mekh. Tekh. Fiz.; 14: No. 2, 101-108(1973).

The results of an experimental investigation of the local mean and fluctuating friction at the wall of a horizontal tube are presented for the case where a gas–liquid stream flows in the tube with a wide range of regime parameters. The electro-diffusion method is used for measuring the friction. Curves of the tangential stresses along the perimeter of the tube as well as along its length are constructed, permitting an objective determination of certain flow regimes. The experimental results are compared with those of the existing computational methods. (Appl. Mech. Rev.)

17147 BOILING HEAT TRANSFER TO A FREON-113 JET IMPINGING UPWARD ONTO A FLAT, HEATED SURFACE. Ruch, M. A.; Holman, J. P. Int. J. Heat Mass Transfer; 18: No. 1, 51-60(Jan 1975).

Experimental measurements of the heat transfer and heat flux to a jet impinging on a heated test surface were obtained in the nucleate and film boiling regimes. Test variables were jet nozzle inside diameter, test surface orientation, and test surface temperature. A generalized correlation of the jet nucleate boiling heat flux was found using a modified form of the Rohsenow pool boiling equation. For Freon-113, dimensional correlation of the heat transfer and heat flux data in both nucleate and film boiling were obtained in terms of the four test variables. (Appl. Mech. Rev.)

Materials Testing

Refer also to abstract 17926.

17148 COLOR RADIOGRAPHY AND SUBTRACTION. Oosterkamp, W. J.; van't Hof, A. P. M. (Philips Gloeilmpenfabrieken N. V., Eindhoven, Netherlands). Excerpta Med. Int. Congr. Ser.; 2: 387-391(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Modern television techniques are used to enhance the observer's perception of radiographic and fluoroscopic images. (NL)

17149 CRACK DETECTION. (to Neratoom N. V.). Netherlands Patent 7,403,033/A/. 6 Mar 1974. 4p. (In Dutch)

A means for crack detection by a penetrating liquid is described. As contrast medium to the liquid, a material that coagulates into a removable film or sheet is proposed so that an imprint of the crack pattern may be retained. Also this material may contain magnetisable particles which arrange themselves in a greater concentration around the cracks when the pieces to be inspected are placed in a magnetic field. (NL)

17150 APPARATUS FOR CARRYING OUT ULTRASONIC INSPECTION OF PRESSURE VESSELS. Dent, K. H.; Challender, R. S. (to United Kingdom Atomic Energy Authority). British Patent 1,401,460/B/. 30 Jul 1975. Filed date 18 Dec 1972. 6p.

Apparatus is described for use in carrying out ultrasonic inspection of coolant nozzles of nuclear reactor pressure vessels. It comprises a manipulator for supporting an ultrasonic scanning transducer within the coolant nozzle. The manipulator is carried by a support located within the pressure vessel and comprises a pair of legs pivotable in caliper manner to span the base of the nozzle. Means are provided for pivoting the legs together to enable free entry of the manipulator and scanning transducer into the nozzle, and for pivoting the legs apart to bring the transducer into an operating position adjacent to the wall of the nozzle. The manipulator is rotatable within the nozzle to enable scanning of its interior surface. (UK)

17151 BIBLIOGRAPHY: ACOUSTIC EMISSION TESTING APPLIED TO WELDED JOINTS. Weld. Res. Int.; 5: No. 2, 78-85(1975).

The bibliography of publications on acoustic emission (stress wave) emission testing applied to welded joints includes 95 references, mainly covering the period 1969 to 1974. Seventeen of the references relate specifically to nuclear industry, covering topics such as the periodic inspection of steel pressure vessels for reactors, monitoring of reactor fuel pin end closure welds, and evaluation of radioactive waste capsule and welds. (UK)

17152 ANALYSIS OF OXYGEN CONTENT IN STEEL BY MEANS OF 14 MeV NEUTRONS. Chuang, L. S.; Wong, K. C.; Chiu, W. Y. (Chinese Univ. of Hong Kong, Shatin). Nucl. Eng. Des.; 34: No. 2, 255-267(Nov 1975).

A sealed-tube type 14 MeV neutron generator with maximum neutron output of 10^{11} n/sec, incorporating a pneumatic sample transfer system of single-tube type with a single rotation of the sample during neutron irradiation, was used to develop a method suitable for routine work in industrial applications. A pulse shape analyzer system incorporating an organic scintillation detector was used for monitoring neutron flux level during the neutron irradiation of the sample. Polyethylene with an oxygen content 163 ppM (determined by comparison with lucite) was used as the steel sample carrier. A 3 × 3 in. NaI(Tl) crystal was used with a single channel analyzer to count the 6.1 and 7.1 MeV γ rays emitted from ^{16}N as a result of the reaction $^{16}O(n,p)^{16}N$. Because the activation analysis makes use of a comparison method, a steel-mylar standard made of layered steel and mylar discs was prepared and a calibration curve constructed. A method of correcting the oxygen contribution from the polyethylene sample carrier was devised, and the content of oxygen in the steel standard was determined. A survey of neutron flux distribution was also attempted, and it was found that a nearly symmetrical distribution of the flux about the center of the sample carrier, which is placed with its axis in parallel to the plane of the disc-shaped target of the neutron-generating tube, was far from being flat. (NL)

Nuclear Explosions

Refer also to abstract 17190.

17153 (AD/A-007439) SOME RECENT DEVELOPMENTS IN FRACTURE MECHANICS. Clifton, R. J. (Terra Tek, Inc., Salt Lake City, Utah (USA)). 13 Nov 1974. Contract DNA001-74-C-0047. 34p. NTIS $3.75.

Recent developments in fracture mechanics, both static and dynamic, are reviewed. These results are presented in order to spur exploitation of fracture mechanics in determining fracture criteria for rocks. Such considerations are important to improve computation predictions of ground motion due to explosions occurring at or near the earth's surface as well as evaluation of containment of gas in a nuclear cavity. (GRA)

17154 (AD/A-008180) PRECURSORS TO PP. Norsar Report on Phase 3. King, D. W.; Haddon, R. A. W.; Husebye, E. S. (Norges Teknisk-Naturvitenskapelige Forskningsraad, Kjeller. NORSAR). 28 Feb 1975. Contract F08606-74-C-0049. 62p. (NORSAR-3-74/75). NTIS $4.25.

The results of a theoretical study of the interpretation of precursors to PP ($\delta \approx 100°$) in terms of scattering by small-scale random irregularities in the crust and uppermost mantle are presented. These results are compared with observational data from two nuclear explosions recorded at the Warramunga array and three earthquakes recorded at the NORSAR array. This comparison reveals that the scattering interpretation offers a plausible and adequate explanation of the detailed observational data, namely: onset times, duration, slowness, azimuth and amplitude variations. The scattering interpretation of PP precursors, along with a similar interpretation of precursors to PKPPKP, removes the need for postulating sharp reflecting discontinuities in the uppermost few hundred kilometers of the crust and upper mantle. (GRA)

17155 (UCID-17015) NADS FSK MODEM, LEA 74-2248. Johnson, K. R. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 12 Jan 1976. Contract W-7405-Eng-48. 29p. Dep. NTIS $4.00.

The Nads FSK Modem is a compact unit designed to operate in conjunction with EIA standard interfacing and the data terminal equipment of the 1200 Baud digital communications network of the Nevada Automated Diagnostics System (NADS). The modem is constructed in a Nuclear Instrumentation Module System (NIMS) module for compatability with the NADS system. The modulator section of the modem accepts serial, digital signals at 1200 Baud which may be either standard TTL levels or bipolar signals meeting either the EIA RS-232C or RS-232B standards. The output of the modulator is a Frequency-Shift Keyed (FSK) signal having frequencies of 2.2 kHz for Mark and 1.2 kHz for Space. The demodulator section accepts the above FSK signal as input, and outputs serial, digital signals at 1200 Baud at either TTL or EIA RS-232C levels. Specifications and operation and calibration instructions are given. (WHK)

17156 STOP NUCLEAR TESTING AS SOON AS POSSIBLE. Meerburg, A. J. Ned. Staatscourant; No. 164, 1, 3(27 Aug 1975).

The article is the text of a speech presented by the Netherlands' delegate to the 1975 Conference of the Committee on Disarmament. The delegate endorses a proposal to study the possibilities of a reduction in military budgets via a comparative evaluation of the budgets of several states. Reduction of national budgets might serve as a safeguard. An expert group was instituted by CCD to realize this proposal. Further, a ban on peaceful nuclear explosions with perhaps a few internationally-licensed exceptions is advocated. (NL)

17157 NUCLEAR ELECTROMAGNETIC PULSE. Lels, H. Noodzaak; 24: No. 6, 132-135(Sep 1975).

All aspects of EMP are considered. The main conclusions from a report by the Civil Defense Staff on possible damage by EMP and the means of protection from this phenomenon are given. A simulator to test these means of protection is called for and has been installed in the Netherlands. The list of references is of importance especially for Dutch and European users. (NL)

17158 APPROXIMATE SPHERICAL BLAST THEORY INCLUDING SOURCE MASS. Freiwald, D. A.; Axford, R. A. (Los Alamos Scientific Lab., NM). J. Appl. Phys.; 46: No. 3, 1171-1174(Mar 1975).

Equations including source mass are presented for strong spherical blasts in cases where the source mass is not negligible. Analytic solutions are obtained for shock speed, position, and overpressure as a function of radius. Approximations similar to those used in the Taylor–Sedov approximate theory are employed. Shock positions as functions of time are obtained via evaluation of incomplete elliptic integrals. Sample calculations are presented for a laser-initiated 1-MJ (debris energy) pellet microexplosion, and compared to Taylor–Sedov approximate theory solutions. 3 figures (auth)

17159 SHOCK WAVES AND MAN. Glass, I. I. Toronto; University of Toronto (1974). 169p. $8.50.

An overview is presented on physical phenomena involving shock waves. The book is organized in nine chapters: (1) Introduction, (2) naturally generated shock waves on Earth, (3) artificially generated shock waves on earth, (4) shock waves in space, (5) peaceful uses of chemical and nuclear explosives, (6) planar, cylindrical and spherical exploding and imploding shock waves, (7) other types of shock waves, (8) some facilities for studying shock phenomena in the laboratory, and (9) shock waves and human conditions. A selected list of references is included. (Appl. Mech. Rev.)

17160 MECHANICS OF NUCLEAR BLASTING. Ratan, S.; Dhar, B. B. (Banaras Hindu Univ., India). Indian Min. Eng. J.; 14: No. 5, 22-27(May 1975).

The mechanics of nuclear blasting are briefly discussed. Information is included on cavity formation, dimensions of rubble chimney, and rock failure mechanisms for both deep and shallow emplacements. (LCL)

17161 NUCLEAR PROLIFERATION: THIRTY YEARS AFTER HIROSHIMA. Feld, B. T. (Massachusetts Inst. of Tech., Cambridge). Phys. Today; 28: No. 7, 23-27, 29(Jul 1975).

The thirty-year-old position–that the only way to ensure an atom-bomb-free future is by strict international control over fissionable materials and their means of production is re-examined. The article is an adaptation of remarks by the author upon his winning and receiving the 1975 Leo Szilard Award which was presented to him at the APS Spring Meeting. (TFD)

Protective Structures and Equipment

Refer also to abstract 19600.

17162 PROCEDURE FOR THE MANUFACTURE OF CONCRETE VESSELS WITH AN INNER LINING TO CONTAIN HAZARDOUS MATERIALS. (to N. V. Schokbeton). Netherlands Patent 7,401,389/A/. 31 Jan 1974. 7p. (In Dutch)

A procedure for the manufacture of concrete vessels with an inner lining to contain hazardous materials is described. The procedure is designed to avoid enclosed air pockets or faults in the concrete like gravel lumps. Protruding reinforcement parts are fitted with rubber buffers to protect the vessel from being damaged in case of accidents (falling from a crane) or rolling away. Also thin-walled vessels can be produced by this method. (NL)

Vacuum Engineering

Refer also to abstract 18350.

17163 FLANGE SEAL WITH RUBBER WASHERS FOR AN ULTRAHIGH VACUUM. Epifanov, V. G.; Lezhnenko, I. V.; Mikhailenko, V. P.; Shavanov, F. A. (Inst. of Metal Physics, Kiev). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 898-899(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 190-191(1975).

A flange seal with rubber washers for ultrahigh vacuum systems is described which allows the system to be heated up to 450°C. A vacuum 2×10^{-9} torr has been obtained on an installation using the proposed seals. It is demonstrated that the limiting vacuum in the system is determined by the evacuation means used rather than by the seals. (auth)

ENVIRONMENTAL AND EARTH SCIENCES

17164 (AED-CONF-74-725-000(Vol.1), pp 212-226) COMPARISON OF THE SIZE DISTRIBUTION OF NEUTRAL AND ACTIVE AEROSOL IN THE ATMOSPHERE. Porstendoerfer, J. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

Natural radioactive atoms (daughters of ^{222}Rn and ^{220}Rn) and fission products (such as ^{131}I, ^{137}Cs) are deposited on the particles in our atmosphere and thus form the radioactive atmospheric aerosol. The deposition process on monodisperse particles was studied theoretically and experimentally by the example of ^{210}Pb. The size distribution of the radioactive atmospheric particles was measured using a high-resolving aerosol spectrometer and compared with the size distribution of the inactive particles in the atmosphere. (DE)

17165 INFLUENCE OF THE ATMOSPHERIC OZONE LAYER ON THE SOLAR UV RADIATION AT THE EARTH SURFACE AND THE PHOTOBIOLOGICAL CONSEQUENCES OF THEIR CHANGES. Klimek, M. (Inst. of Biophysics, Brno). Stud. Biophys.; 52: No. 1, 11-12(1975).

Present knowledge about the ozone layer protecting the earth surface from ultraviolet radiation, particularly far ultraviolet is summarized. The properties of this layer are discussed in connection with recent findings that several factors destroy the ozone layer. Such a decrease in ozone concentration in the stratosphere was caused by nuclear weapons testing. These tests on the earth surface led to a 5% decrease of ozone concentration in the stratosphere and it took several years to compensate this decrease of ozone concentration by its natural formation from O_2. (auth)

17166 CHANGES IN ABYSSAL FLUXES OF RADIOGENIC GASES AS A CONSEQUENCE OF ELASTIC DEFORMATIONS OF THE EARTH'S CRUST. Tugarinov, A. I.; Sardarov, S. S. (Inst. of Geology, Makhachkala, USSR). Dokl. Akad. Nauk SSSR; 223: No. 4, 856-859(1 Aug 1975). (In Russian).

In order to explain the present content of helium, argon and other inert gases in the Earth's atmosphere it is proposed that these gases emanate from the bowels of the earth to the surface. This hypothesis was tested experimentally by using mass spectrometers to measure rare gas fluxes in natural gas wells. The presence of an argon flux was demonstrated convincingly by showing that the ratio of Ar-40 to Ar-36 increases with depth. The presence of a helium flux was confirmed by its accumulation in a gas probe up to concentrations different from its concentration in air. Daily changes were observed in the relative concentrations of helium and argon with depth. Daily variations in the force of gravity, the level of water in a deep well in Central Africa and the fluxes of inert gases in gas wells of Dagestan are compared over a period of one month. There is a good correlation of the inert gas flux with the ebb and flow deformations. A slow accumulation of elastic deformations takes place during the period preceding an earthquake. In this case the average background rises, and it is possible to predict with a probability of 60 to 70% tectonic phenomena 6 to 30 hours before the seismic manifestation. (SJR)

Minerals and Ores

Refer also to abstracts 17281 and 19485.

17167 (PB-239515) URANIUM RESOURCES TO MEET LONG TERM URANIUM REQUIREMENTS. Special Report. (Electric Power Research Inst., Palo Alto, Calif. (USA)). Nov 1974. 123p. (EPRI-SR-5). NTIS $5.25.

Comparison between uranium requirements and uranium resources, the uncertainty concerning the size of the nation's uranium resources, and the future levels of uranium consumption are discussed. Published AEC uranium statistics form the basis for all of the quantitative uranium resource analysis. The United States is essentially unexplored for uranium and much more information is necessary to adequately assess the uranium potential of the country. (GRA)

17168 THEORY AND APPLICATION OF URANIUM ORE GRADE DETERMINATION BY GAMMA RAY SELF ABSORPTION IN LAYERED MEDIA. Gant, O. J. Jr. Dallas; Southern Methodist University (1975). 169p. University Microfilms Order No. 75-22,477.

Thesis (Ph. D.).

The steady state diffusion equation is solved by finite differences for a horizontally layered earth penetrated by a borehole. Volume distributed sources can exist in the layers, or a point source can be inserted on the axis of the borehole. The diffusion parameters and the source strength per unit volume are constant within a given layer. Both a three layer and a five layer model are defined. The set of linear equations for a given model is solved interatively by the overrelaxation technique. Convergence is based on minimization of the largest difference on successive iterations occurring at any point on the grid. The models are employed to describe the transport of gamma rays originating from uranium daughters. Diffusion parameters are obtained empirically to describe both the Compton and photoelectric energy measurements employed in the self absorption method of borehole uranium ore grade determination independent of the state of equilibrium between uranium and its daughters. (Diss. Abstr. Int., B)

17169 TECHNIQUES OF THE NUCLEAR FUEL CYCLE. Pecqueur, M.; Taranger, P. (CEA, Brussels). Entropie; 11: No. 63, 18-27(1975). (In French)

Five main stages can be distinguished in the production of fuel for nuclear power stations: 1. Prospection for uranium deposits; varied and constantly developing techniques are used for this (on the ground, from the air, geochemical, geophysical, etc...). 2. Extraction and production of natural uranium from these deposits. The content of the ores is not generally high, and they have to be treated physically and chemically and concentrated on the site of the deposit. 3. Enrichment of some of this uranium with ^{235}U for plants using this type of fuel. The article describes the gaseous diffusion process, widely used throughout the world and particularly in France. 4. The manufacture of suitable fuel elements for the different plants. 5. Finally, the reprocessing of the irradiated fuel, for the purpose not only of recovering the fissile matter but also of disposing safely of the fission products and other waste. (auth)

17170 STATE OF THE URANIUM-LEAD SYSTEM IN URANIUM ORES (ACCORDING TO DATA OF X-RAY MICROPROBE ANALYSIS). Pavshukov, V. V.; Komlev, L. V.; Anderson, E. B.; Smyslova, I. G. (All-Union Scientific-Research Geological Inst., Leningrad). Geokhimiya; No. 4, 603-613(Apr 1975). (In Russian)

In the absence of superposed processes pitchblende preserves radiogenic lead. This peculiarity of pitchblende is apparently conditioned by the entry of radiogenic lead into a chemical bond with the pitchblende lattice. Radiogenic lead that is formed in uranium minerals of the coffinite and brannerite type is partly evacuated from them by diffusion processes and is sorbed by sulfide minerals. In this connection it is not expedient to sample monomineral fractions of these minerals for isotopic age determinations. (auth)

17171 ENVIRONMENTAL IMPACT OF SOLUTION MINING FOR URANIUM. Hunkin, G. G. Min. Congr. J.; 61: No. 10, 24-27(Oct 1975).

Compared with most other mining systems, uranium solution mining has a negligible effect on such environmental factors as surface disturbance, interference with natural ground water quality and distribution, and aerial discharge of radionuclides. The following topics are discussed: the process, personnel safety and health, tailings disposal, impact on groundwater, operating licenses and controls, legislation, and economics. It is concluded that engineered well systems and controlled input/production flow rates, combined with full recirculation systems that maintain constant fluid volumes in the mineralized formations, result in containment of leach solutions within the operating area. The very dilute leach solutions, compatible with natural groundwaters, ensure that no environmental damage results, even if a loss of control occurred. Reduction in the number of processing steps and virtual elimination of operator hazards, waste disposal and land rehabilitation costs help in reducing overall costs. (JGB)

Radioactivity Monitoring and Transport

Refer also to abstracts 16831, 17172, 17199, 17203, 17250, and 19573.

17172 (DOCKET-406622-7) SHIRLEY BASIN URANIUM MILL. Environmental Report to Accompany Source Material License Application. (Utah International, Inc., San Francisco, Calif. (USA)). Dec 1975. 158p. Dep. NTIS $6.75.

This document summarizes all of the environmental monitoring conducted by Utah. This Environmental Report consequently supplements and updates the information presented in the Source Material License application of August 18, 1970 and the Final Environmental Statement (FES) of December 1974. Water and air quality, liquid waste management, soil/vegetation monitoring, and reclamation are covered. (DLC)

17173 (TT-75-50010) ARTIFICIAL AND NATURAL RADIONUCLIDES IN MARINE LIFE. Tsytsugina, V. G.; Risik, N. S.; Lazorenko, G. E. 1975. Translation of Iskusstvennye I Estestvennye Radionuklidy V Zhizni Gidrobiontov, "Naukova Dumka", Kiev, 1973. 121p. NTIS.

Karyotypes were determined for the scorpionfish, the turbot, and the Mediterranean sardine. Chromosomal aberrations induced by ^{95}Sr, ^{90}Y, ^{91}Y, ^{14}C, and ^{137}Cs are reported for embryos of marine fishes. Uranium concentrations in marine plants and animals are reported. Among the marine plants, brown and red algae showed the highest uranium concentrations. Among animals, molluscs showed highest concentrations and fishes the lowest. Studies were also conducted on extraction of radionuclides by alginic acid from seawater. (HLW)

17174 URAN V SOVREMENNOM MORSKOM OSADKOOBRAZOVANII. (Uranium in Contemporary Marine Precipitation Formation). Baturin, G. N. Moscow; Atomizdat (1975). 152p.

The principal steps in the uranium precipitation cycle are examined for contemporary sea basins. In the annual fluvial discharge to the Pacific Ocean are some 18 thousand tons of solutes and about as much again suspended uranium. In the waters of the open seas and oceans the uranium concentration is 2–3 μg/liter; in the suspensions, an average of 1×10^{-4}%; in contemporary corals, (2 to 4)$\times 10^{-4}$%; in other sea organisms, less than 1×10^{-4}%; and in sea and ocean precipitates, (0.1 to 100)$\times 10^{-4}$%. Depending on the type of basin, uranium accumulates either in silts of the deep-water depressions or in precipitates of the shelves and continental slopes. In the surface layer of sea precipitates, hydrogenic uranium is bound primarily to organic matter, and in the ocean precipitates, with iron, manganese, or phosphorus. With diagenetic processes, uranium is partially redistributed in the precipitates and is concentrated in iron-manganese, phosphite, and carbonate concretions and biogenic phosphate debris. The uranium concentration in sea precipitates of different types depends on their state and on the form of uranium in the basin, the degree of differentiation and the sedimentation time of the precipitate material, the hydrochemical regime in the water and water circulation, and the intensity of the diagenetic processes. 350 references. (tr-auth)

17175 PRIRODNYE IZOTOPY GIDROSFERY. (Natural Isotopes of the Hydrosphere). Ferronskogo, V. I. Moscow; Izdatel'stvo Nedra (1975). 280p.

This book presents factual data on the content of stable and radioactive isotopes of cosmogenic and radiogenic origin. Estimates are given for regularities in the distribution of isotopes in natural waters. A look is taken at the physical and chemical principles responsible for isotopic fractionation and at the main processes leading to the separation of hydrogen and oxygen isotopes in natural waters. A presentation is made of the conditions of investigating water motion in the ocean, the mutual relation between the oceans and surface waters of the continents, and the formation and genesis of underground waters on the basis of using data on isotopic composition. Data are presented on the distribution of tritium and carbon-14 concentrations in natural waters and the use of these data for dating natural waters and resolving other scientific and practical problems. A presentation is given of the principles used in separating out radiogenic, radioactive elements and isotopes in natural waters, and methods of determining the age of natural waters and sedimentary deposits from the isotopes of heavy radioactive elements. A look is taken at the problem of the origin of the Earth's hydrosphere on the basis of analyzing data on the isotopic composition of various types of natural waters. It is concluded that the origin of the hydrosphere is based on condensation in the last stage of the formation of the Earth as a planet. 68 tables, 91 illustrations, 376 references. (SJR)

Atmosphere

Refer also to abstracts 17172, 17372, 17373, and 17473.

17176 (AED-CONF-74-725-000(Vol.1), pp 147-179) SHORT-TIME AND LONG-TIME DIFFUSION FACTORS FOR THE CALCULATION OF THE ENVIRONMENTAL IMPACT OF WASTE AIR PLUMES. Vogt, K. J.; Geiss, H. 1974. (In German).

From annual meeting of the Fachverband Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e. V., Karlsruhe (F. R. Germany)).

Diffusion experiments with labelled plumes are carried out at Juelich Nuclear Research Centre in order to determine the diffusion parameters σ_y and σ_z which are necessary for calculations of the environmental load. The distribution of the concentration near the surface is measured at about 100 sampling points for different types of weather and varying heights of emission (50 m and 100 m). The results show that compared to Pasquill's prognoses the maximum values of concentration near the surface are closer to the source by a factor 2 to 5, depending on the diffusion category, the absolute value of concentration at the peak having been underestimated by a factor of about 2. If the results of diffusion experiments are to be applied to other sites, systems of parameters for the diffusion categories must be developed on the basis of meteorological data which directly correlate to the parameters describing the turbulent state of the diffusion layer (e.g., due to the surface roughness). Statistical returns are therefore established in Juelich in order to determine the relation between the diffusion parameters σ_y and σ_z as measured in experiments on the one hand and vector wind vane measurements as well as stability parameters such as the Richardson number on the other hand. Other investigations are carried out for the establishment of roughness parameters. The results will help to calculate the environmental load of noxious emissions. (DE)

17177 (AED-CONF-74-725-000(Vol.1), pp 191-211) DIFFUSION CONSTANT AND DEPOSITION RATE OF RADIOACTIVE IODINE IN THE ATMOSPHERE. Krzesniak, J. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e. V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e. V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e. V., Karlsruhe (F. R. Germany)).

The iodine emitted from nuclear facilities can be found in the air in different forms, e.g., as vaporous iodine or iodine alloys or deposited on aerosols. The behavior of iodine in the atmosphere depends essentially on the physical properties of the different forms of iodine, i.e., whether it is independent or deposited on particles. For the investigation of the diffusion constants and deposition processes of iodine, generators for the production of iodine and iodomethane were built in the first instance. The diffusion constants and the rate of deposition on aerosols were determined in a diffusion tube under conditions of great exactness. The aerosols studied were artificial monodisperse particles of 0.2–2 μm produced in a La-Mer generator, and atmospheric aerosol. The size distribution of the atmospheric iodine-aerosol particles was also studied experimentally. (DE)

17178 (AED-CONF-74-725-000(Vol.1), pp 227-245) THE CONCENTRATION OF FISSION PRODUCTS AND OTHER RADIONUCLIDES IN THE SURFACE AIR BETWEEN 1971 AND 1973. Kolb, W. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e. V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

The aerosols collected with high-efficiency portable dust samplers in Brunswick and Tromsoe are analyzed in a Ge(Li) spectrometer. The mean monthly activity concentrations are given for a number of cosmogenic and induced radionuclides from nuclear weapons tests as well as for some cosmogenic and natural radionuclides. The annual curve exhibits marked seasonal variations with a pronounced peak—caused by an influx from the stratospheric reservoir—in late spring for all radionuclides studied except for ^{35}S, ^{210}Pb and ^{226}Ra. This peak decreases continuously from 1971 to 1973 for the fission products and induced radionuclides which for the most part had been produced in Chinese nuclear weapons tests. In contrast to ^{7}Be and ^{22}Na, the behavior of ^{35}S suggests that it is partly anthropogenic in origin. The activity concentration of ^{226}Ra in air has been measured directly for the first time. The findings are discussed and finally compared with the maximum permissible concentration for the population. (DE)

17179 (AED-CONF-74-725-000(Vol.1), pp 287-301) SCHEDULED AND UNSCHEDULED EMISSIONS OF RADIOACTIVE FIS-

SION PRODUCTS IN REPROCESSING, FISSION MATERIALS HANDLING AND STORAGE. Laser, M.; Bruecher, H.; Merz, E.; Wolf, J. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

100% of the ^{3}H and ^{85}Kr contained in spent elements as well as non-negligible quantities of ^{129}I, ^{131}I, and aerosols are emitted by reprocessing plants for spent fuel elements. The radiation risk resulting from these routine emissions exceeds the radiation risk from possible accidents. The total risk can be significantly reduced by appropriate measures taken for the retention of ^{3}H and ^{85}Kr and by improvements in iodine retention. The expenditure involved in these improvements is compared with the damage resulting from their neglect. Final storage of radioactive wastes poses considerable danger to the environment over millions of years. The method of storage must therefore be selected for optimum safety in all probability. An example serves to demonstrate that the danger involved in a flooding of a final storage site is relatively small. (DE)

17180 (AED-CONF-74-725-000(Vol.1), pp 302-312) ASSESSMENT OF ACTIVITY CONCENTRATION IN THE AIR DUE TO THE OPERATION OF A HEAVY-ION ACCELERATOR. Borchardt, K. D.; Kirschfeld, K. E. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

The paper discusses problems arising in connection with a heavy-ion accelerator which is to be put into operation at the Hahn-Meitner Institut in Berlin in 1976. Problems of radiation protection are discussed following a short survey on the envisaged constructional design and technical system. In particular, the activation of the surrounding air is estimated on the basis of calculations of the neutron source powers to be expected. The saturation concentrations of the most important gases are given for every nuclear species. As the entry to the experimental hall will not be prohibited during radiation experiments with heavy ions, the test sites (including target and beam catcher) are removed to concrete shields within the experimental hall. The ventilation concept provides for air-conditioned ventilation of the experimental hall and the cyclotron areas and a separate exhaust air system with a high rate of air flow through aerosol filters. Owing to this concept, the activity concentration values for the experimental hall and for concrete shields not in operation are still below the maximum permissible values. The article winds up by discussing aerosol activities in air and their causes. (DE)

17181 (AED-CONF-74-725-000(Vol.1), pp 313-340) INVESTIGATIONS OF THE DISCHARGE OF RADIOACTIVE GASES IN THE ENVIRONMENT OF LOW-ENERGY ACCELERATORS. Friedrich, W.; Knieper, J.; Printz, H.; Sauermann, P. F. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

In the waste air discharged by low-energy accelerators, short-lived radioactive gases such as ^{13}N, ^{16}N, ^{15}O, and ^{41}Ar can be found in addition to ^{3}H. The concentrations of these gases may well exceed the maximum permissible values in accelerators with powerful sources. The waste air concentrations to be expected for the continuous operation of some typical accelerators (15 MeV neutron generators, compact cyclotron, betatron) were estimated and in some cases compared with experimental values. They are found to be in good agreement. The problem of the maximum discharge values for short-lived radioactive materials is again discussed. Discharge values are proposed which were calculated using only the body load produced by gamma or annihilation radiation. (DE)

17182 (AED-CONF-74-725-000(Vol.1), pp 341-359) METHOD OF INVESTIGATION OF THE RADIONUCLIDE CONTENT IN THE EMISSIONS OF NUCLEAR POWER STATIONS. Wolter, R.; Arndt, J. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Shortened version of WaBoLu-16/74. Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

In the operation of nuclear power stations, continuous monitoring of the emission of radioactive substances into the environment is necessary, and an analysis of the various radionuclides is advisable. An adequate method for the monitoring of radioactive emissions was developed. It was based on the following requirements: (a) The detection limit for all radioactive materials which may contribute to the radiation load of the population must be sufficiently low. (b) The measured values must be calibrated in order to enable an exact assessment of emissions to be made. (c) The work must be reduced to a minimum and carried out as a routine task. These demands were met by the consequent use of an EDV computer which was programmed for all calculations. Extensive calculations were put up with wherever they helped to save human efforts. In this connection, pre-programming of all routine calibration steps proved to be of particular importance. The routine of investigation is described. (DE)

17183 (AED-CONF-74-725-000(Vol.1), pp 360-366) DETERMINATION OF RADIOACTIVE SUBSTANCES IN AIR. Maushart, R. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

Artificial α-activity can be distinguished from the natural activity component in air by three fundamentally different methods: pseudo-coincidence difference, α-spectrometry, and decay analysis. The latter is realized by step-by-step filter systems. All three methods have already been discussed in many papers, the most recent of which have been published following the meeting on Monitoring Room and Exhaust Air for Radioactivity of the Fachverband fuer Strahlenschutz in November 1973. Still, two aspects justify this repeated discussion of the subject. For one thing, there is often some uncertainty as to the method to be preferred in practical use and the best application for each method. Secondly, the measuring instruments have been improved and developed by now, giving cause to quite new considerations. The present paper will therefore try to work out some essential criteria to facilitate the decision for one of these systems. In particular, the advantages of the pseudo-coincidence are pointed out. (DE)

17184 (AED-CONF-74-725-000(Vol.1), pp 367-373) PROBLEMS IN THE DETERMINATION OF ALARM THRESHOLDS IN MONITORS FOR RADIOACTIVE AEROSOLS. Dobiasch, W. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

Aerosol monitors are increasingly often equipped with differential alarm thresholds. This kind of alarm threshold has the advantage of prompt alarm triggering in case of an unduly high aerosol activity. Following a description of the functioning of this alarm threshold, a simple method of calculation for the determination of the control value is described. (DE)

17185 (MBL-1975-12) MEASUREMENT OF THE CONCENTRATION OF RADON IN THE AIR. Aten, J. B. T.; Bierhuizen, H. W. J.; van Hoek, L. P.; Ros, D.; Weber, J. (Rijksverdedigingsorganisatie TNO, Rijswijk (Netherlands). Medisch Biologisch Lab. TNO). 1975. 16p. (In Dutch). (IRI-190-01). INIS.

A simple transportable air monitoring apparatus was developed for controlling the radon contamination of air in laboratory rooms. It is not highly accurate but is sufficient to register the order of magnitude of the radon concentration. Air is pumped through a filter for one or two hours and an alpha decay curve of the dust on the filter is determined. Scintillation counting forty minutes after sampling indicates the radon activity. The calibration method of measuring the equilibrium of daughter product concentrations is discussed extensively. (NL)

17186 (NRL-F-54) ENVIRONMENTAL RADIOACTIVITY ANNUAL REPORT, 1974. (National Radiation Lab., Christchurch (New Zealand)). Jun 1975. 43p. Dep. NTIS (US Sales Only) $4.00.

During 1974 the country-wide average deposition of strontium-90 on New Zealand was the lowest since measurements commenced in 1960. A maximum country-wide average level of 3.6 millicuries per square kilometre was deposited in 1964 following the large scale U.S.S.R. and U.S.A. nuclear tests in 1961 and 1962. Annual deposits thereafter decreased to a minimum of 0.8 mCi/km^2 in 1968. Smaller increases reaching a maximum annual deposit of 1.4 mCi/km^2 occurred in the next few years as a result of French nuclear tests in the South Pacific. During 1973 and 1974, however, the country-wide average annual deposit decreased to 0.3 mCi/km^2, less than one-tenth the 1964 maximum. It is estimated that at the end of 1974 about 22% of the total strontium-90 deposition on New Zealand had come from French tests in the South Pacific. The concentrations of strontium-90 and cesium-137 in milk reflect the changes in fallout deposition. The average levels during 1974 were the lowest since measurements commenced. Results for the extended monitoring programme covering the seven low to intermediate power nuclear tests in the 1974 French test series were published in the previous report (NRL-F/53, November 1974). It is expected that future deposition of long-lived material from the 1974 series will be less than that from several of the earlier French test series. In addition the radiation dose resulting from the long-term average levels, since measurements commenced, is small compared not only with natural background but also with common variations in natural background. (auth)

17187 (PB-240405) DETAILED MEASUREMENT OF ^{131}I IN AIR, VEGETATION, AND MILK AROUND THREE OPERATING REACTOR SITES. Weiss, B. H.; Voilleque, P. G.; Keller, J. H.; Phillips, C. R. (Nuclear Regulatory Commission, Washington, D. C. (USA). Office of Inspection and Enforcement). Mar 1975. 81p. (NUREG-75/021). NTIS $4.75.

A study at three nuclear reactor sites to determine ^{131}I concentrations in the air-grass-cow-milk links of the food chain, as these are related to releases from the nuclear power plants, was prepared. The ^{131}I gaseous effluent release rates were measured in terms of other chemical forms of iodine and compared with previous measurements. Concentrations in vegetation were not generally observable, while measured milk concentrations appeared directly related to rainfall. Maximum air-to-vegetation transfer velocities were calculated, and two vegetation-to-milk transfer parameters were determined. (GRA)

17188 (SCPRI(RM)-4-1975) MONTHLY PROGRESS REPORT. (Service Central de Protection Contre les Rayonnements Ionisants, 78 – Le Vesinet (France)). Apr 1975. 11p. (In French). INIS.

This monthly report of the SCPRI exposes an interpretation of the principal results concerning the surveillance of radioactivity in the environment: atmospheric dusts (air at ground level, high altitude air), rainwater, surface water, underground water, irrigation water, drinking water, food chain (milk plants, cattle, fish), seawater around nuclear plant sites and other sites. The activities of various radioisotopes are presented in tables (^{7}Be, ^{95}Zr and ^{95}Nb, ^{103}Ru, ^{131}I, ^{137}Cs, ^{140}Ba and ^{140}La, ^{90}Sr, ^{106}Ru and ^{106}Rh, ^{226}Ra, ^{54}Mn, U and T). A monthly bibliographic selection is also presented. (FR)

17189 BURDEN OF VOLCANIC DUST AND NUCLEAR DEBRIS AFTER INJECTION INTO THE STRATOSPHERE AT 40^0–58^{0}N. Volz, F. E. (Air Force Cambridge Research Labs., Bedford, MA). J. Geophys. Res.; 80: No. 18, 2649-2652(20 Jun 1975).

Meridional profiles of turbidity at some periods after the explosion of Katmai volcano in June 1912 at 58^{0}N are compared with debris burden from Chinese nuclear tests. Katmai turbidity was previously obtained from solar radiation data, and debris burden was calculated from published mixing ratio data. Turbidity and burden generally peak strongly in arctic latitudes. Only two tests show indications of a bulge at 30^0–45^{0}N which probably existed for Katmai dust in spring 1913. The residence time of Katmai dust was found to have been about 1 year, whereas fallout of nuclear debris seems not to have started before the winter following the tests. For September 1912 the total amount of Katmai aerosol is estimated to have been 13 million metric tons. Analogies to predicted meridional distribution of SST pollutants are being mentioned. (auth)

17190 POSSIBLE OZONE DEPLETIONS FOLLOWING NUCLEAR EXPLOSIONS. Whitten, R. C. (Ames Research Center, Moffett Field, CA); Borucki, W. J.; Turco, R. P. Nature (London); 257: No. 5521, 38-39(4 Sep 1975).

Reference is made to Hampson (Nature 250:189 (1974)) who discusses the possible destruction of the Earth's ozone shield by NO generated during nuclear explosions in the atmosphere, and who suggests that if such an ozone decrease were large enough and lasted long enough there might be disastrous effects on the biosphere. This suggestion is assessed quantitatively. Only nuclear explosions occurring near the ground are considered, the NO formed being carried into the stratosphere by the rising fireball. High altitude bursts would probably give a much lower yield, and NO injected above the stratosphere has a shorter photochemical lifetime and is less effective in removing ozone than is NO deposited in the stratosphere. It is concluded that Hampson's concern is well founded. (UK)

Water

17191 DETERMINATION OF NATURAL TRITIUM CONCENTRATIONS IN WATER SAMPLES. Kollar, J.; Tatara, M.; Chorvat, D.; Trnovec, T.; Szlaurova, M. pp 232-238 of Strahlenschutz, Umwelt, und Bevoelkerung. Potsdam, Ger.; Staatliche Zentrale fuer Strahlenschutz (1974).

Changes in the tritium content in the biosphere produced by nuclear and, particularly, thermonuclear explosions in the atmosphere as well as by the peaceful use of nuclear energy have stimulated the growing interest in tritium monitoring. A systematic monitoring of tritium in the biosphere is necessary for the estimation of the possible local hazard due to the incorporation of tritium in the human organism. The relatively low activity of tritium (in comparison with the detection sensitivity of most of the current methods of tritium detection) and its physical parameters require use of specific monitoring procedures for the determination of its natural concentrations. A method for the determination of extremely low tritium activities and an apparatus for the isotopic enrichment of the samples are described. The samples are electrolytically enriched before the measurement. Enriched samples are measured with liquid scintillators. The method was practically used in the monitoring of natural tritium concentration in the vicinity of the atomic power plant A 1. (auth)

17192 ENRICHMENT OF STRATIFIED LAYER WATER WITH RADIUM ISOTOPES. Khusnullin, M. Kh.; Sattarova, F. M.; Zajtsev, V. I. (Tartu Scientific-Research Inst.). Neftеprom. Delo; No. 12, 18-21(1974). (In Russian)

This article considers physical-chemical processes of increasing the concentration of radium isotopes in stratified water layers during the development of oil deposits. It was established that during the displacement of oil by water a radioactive fringe occurs in the forward part of the displacement front, that is, a zone with an increased content of radium isotopes in strata water. The concentration of Ra-226 and Ra-228 attains a value of 10^{-8} to 10^{-9} curies/liter. It is concluded that the radioactive fringe in the stratum is formed because of a transfer of radium isotopes from the oil and from the surface of intrusive ores into the filtered water stream. On increasing the sulfate content of strata water by pumping into the stratum surface waters and displaced water from the petroleum stratum, the radium and barium precipitate in the form of radiobarite in boreholes. (tr-SJR)

Ecosystems and Food Cycles

Refer also to abstract 17474.

17193 IMPORTANCE OF BROWN ALGA CYSTOSEIRA BARBATA POLYSACCHARIDES IN THE EXTRACTION OF Mn FROM SEAWATER. Ryndina, D. D.; Rozhanskaya, L. I. (Inst. of Biology of the Southern Seas, Sevastopol). Biol. Morya; No. 3, 65-68(1975). (In Russian)

Studies on the uptake of Mn-54 from seawater by living, killed, and decomposing Cystoseira barbata thallomas showed that addition of hydrogen sulfide depressed concentration of Mn^{+2} 7.4-fold and of Mn^{+4} 9.8-fold by the organisms. However, addition of H_2S increased the adsorption of the two ionic forms of Mn-54 to alginic acids and algulose derived from the organisms, 3.9- and 12.7-fold, respectively. These differences were ascribed to changes in the pH. (JPRS)

Radiometric Techniques

Refer also to abstract 17270.

17194 DETERMINATION OF RUBIDIUM AND STRONTIUM IN SILICATES BY FLAMELESS ATOMIC-ABSORPTION SPECTROSCOPY. Adjurant to Isotope Dating. Katz, A. (Hebrew Univ., Jerusalem). Chem. Geol.; 16: No. 1, 15-25(Aug 1975).

A new method is described for the determination of Rb and Sr concentrations in silicate minerals and rocks by flameless (heated-graphite furnace) atomic-absorption spectrometry. Matrix ef-

fects, notably perchlorate interference with Rb, Ca with Sr and ionization of Rb^0 to Rb^+, are completely avoided by the addition of sulphuric acid to standards and unknowns of both Rb and Sr and by adding KCl to the Rb solutions before analysis. Absolute amounts down to 1.10^{-10}g Sr and 5.10^{-11}g Rb can be measured with a reproducibility within ±2% (for duplicates). The results obtained on standard silicate rocks are in good agreement with the values recommended by the U.S. Geological Survey (Flanagan, 1973). The method is suitable for Rb and Sr analysis of almost any silicate rock or mineral. It should find important application in Rb-Sr geochronology, where it can be used both for total Rb determination and for calibration of the Sr separation columns. (NL)

17195 HOLOCENE CRUSTAL MOVEMENTS IN TAIWAN AS INDICATED BY RADIOCARBON DATING OF MARINE FOSSILS AND DRIFTWOOD. Taira, K. (Tokyo Univ. of Education). Tectonophysics; 28: No. 1-2, T1-T5(Sep 1975).

17196 ISOTOPIC COMPOSITION OF GROUNDWATER IN SEMI-ARID REGIONS OF SOUTHERN AFRICA. Vogel, J. C.; van Urk, H. (National Physical Research Lab., Pretoria). J. Hydrol.; 25: No. 1-2, 23-36(Apr 1975).

Although the isotope content of precipitation in the semi-arid regions of southern Africa is extremely variable, groundwater samples from the same district are found to have a remarkably constant isotopic composition. The oxygen-18 content of the underground water, in general, varies by about 0.5% in a given area. The differences that occur between different regions are sufficiently large to allow the groundwater of an area to be characterized by means of its oxygen-18 content. In order to localize the infiltration area of an aquifer, radiocarbon dating of the water is used. It appears that the groundwater contains, in general, less of the heavy isotopes than does the precipitation in the recharge area. This indicates that infiltration only takes place during periods of heavy rainfall. Examples are given where the isotope content of the groundwater is used to distinguish between different aquifers in the same region. (NL)

17197 $^{40}Ar-^{39}Ar$ STUDIES OF PRECAMBRIAN CHERTS; AN UNSUCCESSFUL ATTEMPT TO MEASURE THE TIME EVOLUTION OF THE ATMOSPHERIC $^{40}Ar/^{36}Ar$ RATIO. Alexander, E. C. Jr. (Univ. of Minnesota, Minneapolis). Precambrian Res.; 2: No. 4, 329-344(Oct 1975).

Potassium-argon isochron techniques can provide, in principle, an experimental reconstruction of the time evolution of the atmospheric $^{40}Ar/^{36}Ar$ ratio if minerals can be found which contain samples of argon from the ancient atmosphere and which have had a simple geologic history. Authigenic sedimentary minerals with low potassium content appear to be the best candidates. An experimental reconstruction of the evolution of the atmospheric $^{40}Ar/^{36}Ar$ ratio will serve as a test of various models for the chemical and thermal evolution of the Earth. $^{40}Ar-^{39}Ar$ studies of five chert samples from the Swaziland sequence and the Bulawayan and Gunflint Formations indicate that lower Precambrian cherts do not contain appreciable samples of the ancient atmospheric argon and have experienced complicated geologic histories. The chert sample from the Kromberg Formation contains excess ^{40}Ar. The other four samples yield age spectra which are complicated but which are interpretable in terms of geologically reasonable ages. The lack of evidence for argon loss in the chert data suggests that some cherts may prove to be datable sedimentary minerals. (NL)

17198 $^{40}Ar/^{39}Ar$ GEOCHRONOLOGY OF A HIGH-GRADE POLYMETAMORPHIC TERRAIN, NORTHEASTERN STRANGWAYS RANGE, CENTRAL AUSTRALIA. Woodford, P. J.; Mateen, A.; Green, D. C.; Wilson, A. F. (Univ. of Queensland, St. Lucia, Australia). Precambrian Res.; 2: No. 4, 375-396(Oct 1975).

Minerals from the northeastern Strangways Range have been dated by $^{40}Ar/^{39}Ar$ total degassing and incremental heating methods. Four periods of metamorphism are indicated: M1 > 1710Ma, M2 = 1470Ma, M3 = 700-1050Ma, and M4 = 326-353Ma. The two older events are recognized as distinct granulite facies metamorphic episodes, the third event as a complex reheating of the terrain, and the youngest event is the Alice Springs Orogeny. (NL)

17199 CHALK GROUNDWATER TRITIUM ANOMALY: A POSSIBLE EXPLANATION. Foster, S. S. D. (Inst. of Geological Sciences, London). J. Hydrol.; 25: No. 1-2, 159-165(Apr 1975).

Attention is drawn to a mechanism which could profoundly complicate the interpretation of tritium determinations in investigations of the rate of groundwater movement in the British Chalk and other physically comparable formations. It could explain the anomalously low levels of thermonuclear tritium currently observed in the saturated zone of the Chalk aquifer, with important implications for pollution control. (NL)

17200 STRONTIUM-ISOTOPE COMPOSITION IN THE TETHYS SEA, EUBOEA, GREECE. Tremba, E. L. (Ohio State Univ., Columbus); Faure, G.; Summerson, C. H.; Katsikatsos, G. C. Chem. Geol.; 16: No. 2, 109-120(Sep 1975).

The $^{87}Sr/^{86}Sr$ ratios of the Tethys Sea have been determined by analyzing limestones of Permian to Late Cretaceous age from the overthrusted sequence of central and northern Euboea. The results are in satisfactory agreement with ratios obtained by other investigators on unreplaced fossil shells of similar age collected elsewhere. The $^{87}Sr/^{86}Sr$ ratios of Mesozoic marbles from the autochtone metamorphic rocks of southern Euboea are more variable, perhaps because of increases in this ratio during regional metamorphism. Nevertheless, the lowest values of suites of isochronous samples may approach the correct ratio. Four samples of the Argyron Marble taken at different localities in southern Euboea and on the Attic peninsula have a concordant $^{87}Sr/^{86}Sr$ ratio of 0.70688 ± 0.00006 relative to 0.7080 for the Eimer and Amend isotope standard. This value indicates a Jurassic age for this formation even though the fragmentary fossil evidence favors a Late Cretaceous (Turonian) age. (NL)

17201 EVALUATION OF THE URANIUM–THORIUM–HELIUM METHOD FOR DATING YOUNG BASALTS. Leventhal, J. S. (Univ. of Arizona, Tucson). J. Geophys. Res.; 80: No. 14, 1911-1914(10 May 1975).

Comparison of K-Ar and ages based on U-Th-He on young basalts from the San Francisco Volcanic Field near Flagstaff, Arizona, shows that approximately one fifth of the He is retained and thus U-Th-He ages are too young. Leaching with weak acid produces large losses of U in only a few minutes, which suggests that He is lost from surficial positions on minerals from radiation damage sites and from interconnecting crystal defects. One sample of large plagioclase phenocrysts showed excess He. It seems unlikely that the U-Th-He method can be used to obtain reliable ages on young basalts. (auth)

Thermal Effluents

Refer also to abstract 17203.

17202 (DP-1398) CLAM SURVIVAL IN CHLORINATED WATER. Tilly, L. J. (Du Pont de Nemours (E. I.) and Co., Aiken, S. C. (USA). Savannah River Lab.). [nd]. Contract AT(07-2)-1. 10p. Dep. NTIS $4.50.

Applications of 10 to 40 ppM chlorine were ineffective in control of Asiatic clams that had colonized the suction well of a cooling water pump for one of the Savannah River production reactors. Accumulated mud on the floors and walls of the basin protected large numbers of clams from lethal chlorine exposures. After clams were removed from chlorine exposures of 9, 17, 25, and 54 hours, respective survivals after seven days in a recovery chamber were 97 percent, 84 percent, 47 percent, and 10 percent. Of the clams that were protected by mud during the entire test (54 hours), 65 percent were alive after seven days in the recovery chamber. (auth)

Chemical Effluents

Refer also to abstracts 16586, 17175, and 17190.

17203 (DEU-74-01(Rev.2)) POWER ECONOMY AND ITS INFLUENCE ON THE ENVIRONMENT IN THE FEDERAL REPUBLIC OF GERMANY. Geiger, B.; Layer, G.; Peter, U.; Rudolph, M.; Schaefer, H. (Forschungsstelle fuer Energiewirtschaft, Muenchen (F. R. Germany); Technische Univ. Muenchen (F. R. Germany). Inst. fuer Energiewirtschaft und Kraftwerkstechnik). Jul 1974. 63p. (In German). INIS.

Available from ZAED.

The present paper deals with the environmental impact of the thermal load and the emission of pollutants caused by energy conversion and discusses their quantitative recording within major balance regions. The radiation load to the environment of nuclear energy is illustrated in the annex. (DE)

INSTRUMENTATION

Radiation Detection Instruments

Refer also to abstracts 17076–17078 and 17636.

General Detectors and Monitors

Refer also to abstracts 17496, 17948, and 18091.

17204 (AED-CONF-75-141-021) MEASUREMENTS OF THE SPATIAL RESOLUTION OF A GAMMA CAMERA. Seebeck, V. (Mueller (C.H.F.) G.m.b.H., Hamburg (F. R. Germany)). 1975. 6p. (In German). INIS.

From 6th scientific meeting of the Deutsche Gesellschaft fuer Medizinische Physik; Berlin, F. R. Germany (28 Apr 1975).

Available from ZAED.

The resolving power of a γ-camera at the point of measurement (i.e., in an organ of the patient to be examined) depends on the inherent resolving power, the resolving power of the collimator which is dependent on its raster structure, the effect of the distance between the measured object and the collimator surface, as well as the scattering of the γ-quanta into the matter surrounding the measured object. These various influences are discussed in the present paper by the example of a number of measurements. (DE)

17205 (CEA-CR-3, pp 78-103) QUANTITATIVE DYNAMIC STUDIES BY THE USE OF SCINTILLATION CAMERAS. Application to Cardiology. Planiol, T.; Itti, R. 1975. (In French).

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Biologie).

The main technical and methodological novelties adopted or proposed during the last few years concerning the basic equipment needed for quantitative dynamic studies are reviewed. To this end the different components of an analysis unit are dealt with point by point to show up some of the improvements made on both the detector, which in most cases is still the scintillation camera, and the processing system. A few examples of methodological progress are also given. Some applications in cardiology are then mentioned, with special reference to the quantitative data supplied by the various methods available owing to the scintillation camera and the practical and clinical conditions under which these methods are applicable: gamma-angiocardiography, gamma-cinecardiography, the study of myocardium perfusion. It is shown that most parameters useful to cardiologists can be calculated by the use of these methods. (FR)

17206 (CEA-CR-3, pp 122-125) IS IT PRACTICAL TO USE THE GAMMA CAMERA DEAD TIME. Morin, P. P.; Morin, J. F.; Caroff, J.; Lahellec, M.; Savina, A. 1975. (In French).

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Biologie).

The linearity of gamma camera counting is an essential feature for users engaged in quantitative dynamic studies. Instead of defining this quality by the usual dead time, the disadvantages of which are reported, it is proposed to use the experimental count rate giving 10% loss. It is shown that by proceeding in this way all ambiguity would be abolished, where both the counting linearity itself and its relation to sensitivity are concerned. (FR)

17207 (COM-75-10342) SEMICONDUCTOR MEASUREMENT TECHNOLOGY: IMPROVED INFRARED RESPONSE TECHNIQUE FOR DETECTING DEFECTS AND IMPURITIES IN GERMANIUM AND SILICON P–I–N DIODES. Final Report. Sher, A. H. (National Bureau of Standards, Washington, D. C. (USA)). Feb 1975. 29p. (NBS-SPEC.PUBL.-400-13). NTIS $3.75.

An infrared response (IRR) technique was evaluated for its utility in qualifying germanium for radiation detector use. Because of several improvements in the sensitivity and interpretation of the technique made during the evaluation, it was possible to observe a number of discrete energy levels lying within the forbidden energy gap of germanium which had passed unobserved in previous studies. These levels correlated with the type of defects and vacancies introduced by radiation damage into germanium as measured using such techniques as photoconductivity and Hall effect measurements after irradiation. Furthermore, the improved infrared response measurement method was used to identify impurities, such as copper, gold, and iron, and dislocations resulting from heat treatments in germanium. A major advance was made when it was determined that the IRR spectra could be grouped into five distinct types on the basis of spectral features observed in the energy range from 0.6 to 0.7 eV. (GRA)

17208 EVALUATIONS OF COLLIMATORS FOR RECTILINEAR SCANNING. Christie, J. H.; Ehrhardt, J. C.; Lensink, S. C.; Oberley, L. W. (Iowa Univ., Iowa City). Excerpta Med. Int. Congr. Ser.; 2: 589-594(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Data are presented that could stimulate innovations in the design of collimators for rectilinear scanners. It is stressed that a focussing collimator is not needed to obtain adequate sensitivity for a particular resolution. The only advantage a focussing collimator has is to move the region of best response away from the collimator face. (NL)

17209 SOME RECENT DEVELOPMENTS IN THE FIELD OF γ CAMERAS (γ CINEMATOGRAPHY). Kellrshohn, C. (Service Hospitalier Frederic Joliot, Orsay, France); Gaucher, J. C. Excerpta Med. Int. Congr. Ser.; 2: 329-332(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A γ camera with a cesium iodine crystal and an image intensifier is described. A good spatial resolution is combined with a high efficiency thus enabling very rapid sequential scintigraphy. (NL)

17210 LIQUID SCINTILLATION ANALYZER. Techn. Gids Ziekenhuis Instelling; 44: No. 1086, 791(14 Oct 1975). (In Dutch)

A new type of liquid scintillation analyzer is described and its demonstration at an international exhibition on instruments is announced. 300 samples mounted on 30 trays can be analyzed in one run. The apparatus may be programmed at will. Separate channels for external calibration are present. More facilities for research purposes can be added. The manufacturer is Philips Nederland B. V. at Eindhoven, Netherlands. (NL)

17211 COMPUTATION OF RESPONSE FUNCTIONS OF MULTI-ANNULAR CONICAL FOCUSING COLLIMATORS. Bell, T. K. (Royal Victoria Hospital, Belfast); Johnston, A. R. Excerpta Med. Int. Congr. Ser.; 2: 534-536(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

17212 SYSTEM FOR LOCATING ANATOMICAL REFERENCES IN GAMMAGRAPHS WITH GAMMA CAMERAS. Baptista, A. M.; Lopes, J. F.; Godinho, F. Arq. Patol. (Lisbon); 46: No. 1, 27-30(Apr 1974). (In Portuguese).

A simple anatomical marking system for gamma cameras is described. The coordinates of an index, that can be moved over a frame mechanically linked to the crystal, are transferred to electrical voltages applied to the display part of the camera. It is not necessary to modify the circuit of the camera and one can switch from imaging to marking and vice versa by means of a switch. (auth)

17213 POCKET-SIZED GEIGER COUNTER BUILT WITH THREE MICROPOWER ICs. Tilicsek, J.; Wittlinger, H. A. (RCA, Somerville, NJ). Electron Des.; 22: No. 8, 114(12 Apr 1974).

Introduces a circuit for a miniature Geiger counter, which features a 1-mA count-rate meter and aural output. (Electr. Electron. Abstr.)

17214 GAMMA SAMPLE CHANGER: MOD. II (3 Dec 1974) (Engineering Materials). (California Univ., Livermore (USA). Lawrence Livermore Lab.). (CAPE-2413).

The Gamma Sample changer is a manual or totally automatic (computer operated) sample changer and analyzer which holds 16 samples. These samples are manually loaded in various types of holders. An intermittent motion conveyor mechanism automatically positions samples over a left mechanism. Samples are then raised and positioned a certain distance from the face of a shielded detector. The height of the sample or distance from the detector is automatically determined by the gamma flux level of the sample. A programmed height index drum locates the sample very accurately for analyzing. Photo diode type shaft incoders are utilized in identifying samples, programming and recording data. (auth)

17215 AUTOMATION OF DATA COLLECTION AND COMPUTATION FUNCTIONS FOR MONOCHROMATIC X-RAY ABSORP-

TION ANALYSIS (31 AUG 1971) (ENGINEERING MATERIALS). (Oak Ridge Y-12 Plant, Tenn. (USA)). (CAPE-2414).

A system for simplifying and speeding up the analysis of monochromatic x-ray absorption is described. The previous method in use required close attention to the operation of the x-ray instrument and extensive manual calculation to obtain the results. Measurement of the absorption of x rays at wavelengths on either side of an absorption edge of the element of interest was accomplished using an x-ray spectrometer as a means of selecting the desired x-ray wavelengths. The x rays passing through the sample in a preset time were counted by a scintillation detector and associated electronics. Calculation of the element concentration by a derived x-ray absorption equation involved the difference of the logarithms of ratios of x-ray counts through water to x-ray counts through the sample at two wavelengths. With manual desk calculators and logarithm tables, much time was required and many opportunities for error were present. In order to simplify and speed up the analysis, a small, dedicated computer was interfaced to the spectrogoniometer and scalar units of the x-ray instrument. The computer controlled the functions of setting the spectrogoniometer angles, starting and stopping the scalers, accepting the scaler data, calculating the sample results, and printing these results in final form via Teletype. Supplementary software was provided for calculating the necessary constants in the x-ray absorption equation. (auth)

17216 GAMMA RAY CAMERA SYSTEM WITH CORRUGATED COLLIMATORS. Muehllehner, G. (to G. D. Searle and Co.). US Patent 3,921,000. 18 Nov 1975. Filed date 7 May 1973. 7p.

A gamma ray camera system, such as an Anger-type camera, fitted with a collimator comprising an arrangement of straight and corrugated strips of lead foil is described. One embodiment comprises a parallel multichannel collimator employing corrugated strips with regular, parallel corrugations. A second embodiment comprises a focusing multi-channel collimator employing corrugated strips having corrugations which focus substantially to a common point and are generally wider and deeper on the side more remote from said common point. (auth)

17217 TELEVISION COUNTER FOR FISSION-FRAGMENT TRACKS. Zhuk, I. V.; Malakhov, V. A.; Malykhin, A. P.; Smirnov, V. V. (Nuclear Energy Inst., Minsk). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 883-886(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 179-181(1975).

A television (TV) unit for automatically counting the tracks on solid detectors is described. The device is based on a PTU-101 television unit and a MIM-8M microscope. Recommendations for the choice of illumination arrangements, the type of pickup tube, and detector material are made. The integrated-circuit television computer device contains a digital block for isolating the television fields, circuits for delaying the video signal by the line sweep period, and video-pulse normalization circuits. The processing algorithm operates by obtaining the difference between the number of all intersections of track images and the number of coincidences of direct and delayed video signals. (auth)

17218 MAIN PRINCIPLES OF DESIGNING OF A RADIOLOGICAL ENDORADIOPROBE. Gugnin, Yu. Ya.; Kalantarov, K. D. (All-Union Scientific-Research Inst. of Sharp Medical Instruments, Moscow). Med. Radiol.; 16: No. 1, 56-60(Jan 1971). (In Russian).

The paper discusses the possibility of diagnostic use of radioactive indicators recorded by means of an autonomous radiation detector. The authors depict the principles of designing a radiological endoradioprobe and present data on such a detector. (auth)

17219 SEALED PROPORTIONAL COUNTERS FOR DETECTION OF SOFT X-RAYS IN SPACE APPLICATIONS. Viktorov, S. V.; Kocharov, G. E.; Metveev, G. A.; Chesnokov, V. I. (Ioffe Inst. of Physics and Tech., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 161-167(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 435-444(1975).

Sealed proportional counters for soft x rays used in the RIFMA and RIFMA-M automatic spectrometric complexes are described. Tests of these counters and their characteristics are reported. Some results found in measurements of the chemical composition of the lunar soil and the x-ray emission of the sun with this apparatus of Lunakhods 1 and 2 are reported. (auth)

17220 MULTIPLEX SYSTEM FOR COMPUTER-BASED DATA ACQUISITION IN NUCLEAR PHYSICS. Unternaehrer, J.; Mueller, R. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Kernphysik). Nucl. Instrum. Methods; 128: No. 2, 373-377(1 Oct 1975).

A fully programmable multiplex system for detecting twofold coincidences among six particle detector signals is described. Up to two linear signals per detector are routed through linear gates to analog-to-digital converters. An analog pulse with a height proportional to the time delay between the two events in coincidence is also available. The dead time for a rejected event is 30 ns. (NL)

17221 XENON-FILLED MULTIWIRE AREA DETECTOR FOR X-RAY DIFFRACTION. Cork, C.; Hamlin, R.; Vernon, W.; Xuong, N. H. (California Univ., La Jolla, San Diego (USA). Dept. of Physics); Perez-Mendez, V. (California Univ., San Francisco (USA). Dept. of Radiology). Acta Crystallogr., Sect. A; 31: No. 5, 702-703(1 Sep 1975).

A xenon-filled multiwire proportional chamber with high and uniform photon-detection efficiency has been built and incorporated into a high-speed data collection system for protein crystallography. This system has been used to collect more than 200,000 reflection intensities from one parent and four heavy-atom derivative crystals of a complex of dihydrofolate reductase and metho-trexate (a cancer drug). Its data collection rate is about 30 times faster than the rate of a standard diffractometer (1400 reflection intensities per hour). The precision of the chamber data is also better with an intensity reliability R of 5% as compared with 6.7% from the diffractometer data. The difference Patterson maps between parent and heavy atom derivative data show very clearly the positions of the heavy atoms. (DK)

17222 NATURAL QUARTZ: A USEFUL DETECTOR FOR IN-CORE MEASUREMENTS. Khan, H. A. (Pakistan Inst. of Nuclear Science and Technology, Rawalpindi). Nucl. Instrum. Methods; 128: No. 2, 245-250(1 Oct 1975).

Experiments have been carried out to study the track registration and retention properties of natural quartz crystals. The results indicate that important characteristics such as the critical angle of etching, the etchable track formation efficiency, the maximum etched track length and the track stability against high temperature annealing depend upon the particular crystallographic plane. It has also been observed that a natural quartz crystal is more efficient than fused silica (Vitreosil) for the registration and retention of fission fragment latent damage trails at elevated temperatures. Preliminary results indicate that γ doses below approximately 200 Mr do not affect the above-mentioned properties of these crystals. The experiments seem to suggest that a natural quartz crystal is probably the only known insulating solid in which the fission tracks are fairly stable, (a) at temperatures as high as approximately 800°C (maintained for a few hours), and (b) under fairly severe background conditions. It may therefore prove to be an extremely useful track detector for measurements in high temperature and radiation environments such as reactor cores. (NL)

17223 COMPTON POLARIMETER FOR MEASURING THE LINEAR POLARIZATION OF THE γ-RADIATION FROM NUCLEAR REACTIONS. Kreische, W. (Erlangen-Nuernberg Univ., Erlangen (F. R. Germany). Physikalisches Inst.). Nucl. Instrum. Methods; 128: No. 2, 261-265(1 Oct 1975). (In German)

A Compton polarimeter consisting of a plastic detector as scatterer and two NaI-crystals for the detection of the scattered quanta is described. Measurements were done with the deexcitation γ-rays of the first excited levels in ^{56}Fe, ^{54}Fe, ^{28}Si, ^{12}C following p,p'-reactions. (NL)

17224 THEORY OF CORRELATION MEASUREMENT IN TIME AND FREQUENCY DOMAINS WITH ^{252}Cf. Mihalczo, J. T.; Pare, V. K. (Oak Ridge National Lab., TN). Ann. Nucl. Energy; 2: 97-105(1975).

The theory of cross-correlation measurements between the pulses from an ionization counter containing a ^{252}Cf neutron source, which furnished the initiators of fission chains in a neutron-multiplying assembly, and the pulses from a detector observing the particles from the fission chains is reviewed. The expression for the detector response in this type of measurement is first presented in the time domain. Then the cross-power spectral densities in the frequency domain measurements are developed. The theory of the usual two-detector noise measurement is reformulated to incorporate a modified Diven factor that includes the effects of neutrons from external sources such as spontaneous fission of the californium and the reactor fuel. Finally, the equivalence between both the time and frequency domain expressions is demonstrated. A new method of reactivity determination is proposed which avoids some of the difficulties of the present methods, such as dependence on detection efficiency and inherent source strength, and the requirement for a calibration near delayed criticality. (auth)

17225 SUPERCONDUCTING THIN-FILM LOW-ENERGY PARTICLE DETECTOR. Hoyle, J. A.; Humphris, R. R.; Boring, J. W. (Univ. of Virginia, Charlottesville). IEEE Trans. Magn.; MAG-11: No. 2, 690-693(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Techniques for constructing a superconducting thin-film particle detector have been developed. Detecting surfaces were fabricated by evaporating a 500 A tin-indium film on a glass cover slide and scratching to obtain a 1 micron strip. At a point just below the T/sub c/ and at current densities near I/sub c/, pulses due to single incident Ar, Ar^+, He, and He^+ particles were observed. Pulses were observed for helium and argon down to 200 eV and 150 eV respectively and up to approximately 800 eV. The response of the detector to ions and neutral particles was identical with near 100 percent efficiency. Calculated values for the size of normal regions of the film due to incident particles were of the same order of magnitude as those measured. Pulse height analysis indicated no dependence on incident particle energy. It was concluded that this lack of pulse height dependence on incident energy was due to an intrinsic fluctuation phenomenon of the superconducting film. (auth)

Radiation Dosimeters

Refer also to abstract 19278.

17226 (ORNL-5046, pp 53-56) DOSIMETRY INTERCOMPARISON STUDIES. Becker, K.; Fox, W. F.; de P. Burke, G.; Gesell, T. F.; Dickson, H. W.; Haywood, F. F.; Ward, D. R. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Topics reported on include nuclear accident dosimetry, personnel monitoring intercomparison, and international intercomparison of environmental dosimeters under field and laboratory conditions.

17227 (ORNL-5046, pp 59-63) DOSIMETRIC APPLICATIONS OF PARTICLE-TRACK ETCHING. Becker, K.; Jun, J. S.; Abdel-Razek, M. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Spark counting of particle tracks in mica, spark counting of neutron-induced recoil particle tracks, and transfer dosimeters for fast neutron sources are discussed. (WHK)

17228 (ORNL-5046, pp 65-68) EXOELECTRON AND THERMOLUMINESCENCE DOSIMETRY WITH BeO. Becker, K.; Huskey, L.; Cheka, J. S.; Kerr, G. D.; Crase, K.; Jun, J. S.; Gammage, R. B. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Beryllium oxide is one of the most potentially useful materials, in the tissue-equivalent range, as a solid-state integrating dosimeter. It is hoped to exploit its use both as a thermally stimulated exoelectron (TSEE) and as a thermoluminescent dosimeter (TLD), particularly in situations where other types of integrating dosimeters are nonexistent or inadequate. This material also exhibits unique characteristics in its response to nonionizing radiation. Research is reported. (WHK)

17229 (ORNL-5046, pp 254-255) SOME OPERATING CHARACTERISTICS OF TISSUE-EQUIVALENT PROPORTIONAL COUNTERS. Shonka, J. J.; Gritzinger, C. M.; Poston, J. W. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

The chemical composition of A-150 tissue-equivalent Shonka plastic is given, and characteristics of a Shonka plastic proportional counter for neutron dosimetry are discussed. (WHK)

17230 (PB-239725) COMPARISON OF CaF_2:Mn AND LiF THERMOLUMINESCENT DOSIMETERS FOR ENVIRONMENTAL RADIATION MONITORING. Final Report. Partridge, J. E.; Windham, S. T.; Eakins, J.; Lochamy, J. (Eastern Environmental Radiation Facility, Montgomery, Ala. (USA)). Dec 1973. 14p. (EPA-520/5-73-006). NTIS $3.25.

Two types of thermoluminescent dosimeters, commonly used for environmental radiation monitoring, were evaluated and compared. The study consisted of approximately four months of field evaluation as part of a pre-operational survey at a nuclear power plant. The evaluation consisted of comparing the average microroentgens/hr readings obtained at each of eight sites for the period of the study. The precision of reproducibility for both systems was determined to be approximately 3%. The difference in the average microroentgens/hr readings for the two systems ranged from 16% to 30% at the various sites. (GRA)

17231 MICRODOSIMETRY IN ELECTRON BEAMS. Bengtsson, L. G.; Lindborg, L. (National Inst. of Radiation Protection, Stockholm). Excerpta Med. Int. Congr. Ser.; 2: 485-489(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

When a proportional counter, filled with tissue equivalent gas and surrounded by tissue equivalent walls is exposed to an electron beam, the measurement of variations in the direct current from this counter can yield information on the mean square specific energy of the applications. It was found that the microscopic pattern of energy deposition in high energy electron beams is not strongly different from that in cobalt-60 γ-ray beams. (NL)

17232 FURTHER DEVELOPMENTS OF THERMOLUMINESCENT DOSIMETRY. Cameron, J. R.; Pearson, D. (Wisconsin Univ., Madison). Excerpta Med. Int. Congr. Ser.; 2: 490-494 (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A review is given of the possible applications of thermoluminescent dosimetry in various fields. (NL)

17233 CLINICAL DOSIMETRY BY MEANS OF THERMOLUMINESCENT DOSEMETERS. Ruden, B. I. (National Inst. of Radiation Protection, Stockholm). Excerpta Med. Int. Congr. Ser.; 2: 495-501(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A review is given of the experiences with and value of thermoluminescent dosemeters in a radiotherapeutic clinic. (NL)

17234 CLINICAL DOSIMETRY BY MEANS OF SEMICONDUCTORS. Parker, R. P. (Royal Marsden Hospital, Sutton, Eng.); Stacey, A. J. Excerpta Med. Int. Congr. Ser.; 2: 502-507(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

The silicon diode suffers from certain disadvantages in respect to quality dependence and temperature effects, but it can serve well as a dosemeter because of its sensitivity and fast dose-rate response. For a number of applications, cheap solar cells or selected radio diodes may be used, providing low-cost rugged instrumentation. (NL)

17235 APPLICATION OF THERMOLUMINESCENT DOSIMETERS FOR MEASUREMENT OF MIXED NEUTRON-γ BEAMS. Attix, F. H.; Gorbics, S. G.; Theus, R. B. (Naval Research Lab., Washington, DC). Excerpta Med. Int. Congr. Ser.; 2: 508(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

17236 PROGRESS IN DOSIMETRY WITH RADIOPHOTOLUMINESCENCE DETECTORS. Maushart, R. (BF-Vertriebs-G.m.b.H. fuer Messtechnik, Karlsruhe, Ger.). Excerpta Med. Int. Congr. Ser.; 2: 509-517(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

One of the most important advantages of radiophotoluminescence dosemeters is their reproducibility. Advantages and disadvantages relative to other dosemeters, especially thermoluminescent dosemeters, are discussed. (NL)

17237 PHOTON SPECTROMETRY WITH SOLID-STATE DETECTORS. Drexler, G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg, Ger.). Excerpta Med. Int. Congr. Ser.; 2: 518-522(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

The applications of solid-state radiation detectors as tools in diagnostic procedures and for dosimetry in nuclear medicine, biomedical radiography, radiotherapy and radiation protection are presented. (NL

17238 CHEMICAL DOSIMETRY OF FAST ELECTRONS. Ellis, R. E. (Leeds General Infirmary, Eng.). Excerpta Med. Int. Congr. Ser.; 2: 462-466(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

17239 DOSIMETRY STANDARDS FOR FAST ELECTRONS. Loevinger, R. (National Bureau of Standards, Washington, DC). Excerpta Med. Int. Congr. Ser.; 2: 467-471(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A description is given of a graphite calorimeter designed at the USA National Bureau of Standards. The calorimeter is calibrated against a standard ionization chamber for electron beams of energies from 15 to 50 MeV. It is intended to use graphite calorimeters for the measurement of absorbed radiation doses due to the energy losses of fast electrons. (NL)

17240 USE OF THERMOLUMINESCENT MATERIALS FOR DOSE AND DOSE DISTRIBUTION INTERCOMPARISONS IN X-RAY FIELDS. Puite, K. J.; Crebolder, D. L. J. M. (Association Euratom-ITAL, Wageningen, Netherlands). Newsletter on the Application of Nuclear Methods in Biology and Agriculture; No. 3, 33-36(Nov 1974).

17241 THERMOLUMINESCENT DOSIMETER IN THE NATION-WIDE PERSONNEL DOSIMETRY SERVICE. Fejtek, J.; Trousil, J. Radioisotopy; 15: No. 3, 357-366(1974). (In Czech).

The authors describe the dosimetric properties (radio-thermoluminescent sensitivity, fading, energy dependence, detection threshold, reproducibility and the usability of a second measurement) of alumino-phosphate glasses of Czechoslovak make and compare them with the properties of LiF detectors. (auth)

17242 PHOSPHOR FOR THERMOLUMINESCENT RADIATION DOSIMETER. Nada, N.; Yamashita, T. (to Matsushita Electric Industrial Co., Ltd.). US Patent 3,920,998. 18 Nov 1975. Priority date 29 May 1970, Japan. 4p.

Phosphor composed primarily of BeO and more than 0.5 percent and up to 10 percent by mole of at least one activator selected from the group consisting of lithium, sodium and potassium is prepared by mixing a raw material high purity beryllium oxide with at least one kind of the activators of lithium, sodium and potassium and sintering the resulting mixture in a covered crucible at a temperature of 1,500°C to 2,100°C for 3 to 24 hours and is used for a thermoluminescent radiation dosimeter. The material can exactly measure the radiation dose up to a high level such as 1,000 to 2,000 roentgens. (auth)

17243 USE OF PHOTOLUMINESCENT GLASSES FOR MEASURING IONIZING RADIATION EXPOSURES. Kodl, O.; Trousil, J. Radioisotopy; 15: No. 1, 147-154(1974). (In Czech).

The authors studied the dosimetric properties of the photoluminescent glasses Toshiba FD 3. They found that the sensitivity of the glasses diminished at repeated regeneration and reached a stable state, that after high exposures the background of the detector increased, and that linearity of the response was retained. (auth)

17244 USE OF SILICON DIODE IN PERSONAL NEUTRON DOSIMETRY. Frank, H.; Seda, J.; Trousil, J.; Rusnok, J. Radioisotopy; 15: No. 3, 387-400(1974). (In Czech).

The dosimetric properties of a silicon diode of Czechoslovak make (dependence of diode potential changes as a function of fast neutron fluency, gamma sensitivity and fading) are described. The properties are comparable with those of the Swedish silicon diode AEG. (auth)

17245 USE OF RADIOPHOTOLUMINESCENCE DETECTORS IN THE DOSIMETRY OF IONIZING RADIATION. Kodl, O.; Trousil, J. Jad. Energ.; 20: No. 8, 272-277(1974). (In Czech).

Experimental results have shown that the photoluminescent detector Yoketa FD P8-3 can be used for the measurement of exposures and/or doses of ionizing radiation in a range from 50 mR to over 1500 R whereby the total error in determining exposure over 1 R does not exceed ± 5% and around 100 mR the error of measurement is lower than ± 15%. The growth factor asserts itself within 6 days after irradiation at a temperature of 100°C for a period of 10 minutes the maximum is reached immediately. The response can be measured repeatedly, the error at repeated measurements is minimal (± 1%) provided that subsequent repetitions do not exceed 10 measurements. The low fading of RPL glasses which, after 300 days is lower than 2%, permits to exploit the advantages of long-term integration of exposures. The method chosen for compensating energy dependence (filter 0.9 mm Sn and a plastic) permits measurements in an energy range from 50 keV to 3 MeV with an error not exceeding ± 15%. The glasses can be regenerated, i.e., previous exposures can be removed by heat treatment, giving optimal results at a temperature of 410°C for a period of 1 hour. The photoluminescent glasses change their sensitivity after regeneration in such a way that at repeated regeneration procedures the sensitivity is reduced by 10% and then it remains constant. The background of photoluminescent glasses increases at repeated regenerations only at higher exposures (of the order of 1000 R) and through regeneration or several repeated regenerations a stabilized sensitivity can be achieved. At a repeated regeneration cycle the glasses retain a linearity of dependence of the RPL response to exposure. A serious drawback is the laborious cleaning of the glasses, since neglect in the devised method of cleaning may cause errors higher than ± 50%. (auth)

17246 CALIBRATION TECHNIQUES FOR THE CALORIMETRIC ASSAY OF PLUTONIUM-BEARING SOLIDS APPLIED TO NUCLEAR MATERIALS CONTROL. ANSI-N15.22-1975. New York; American National Standards Institute, Inc. (1975). 30p. (ICONS-02095).

This standard establishes methods and procedures for the calibration of heat-flow calorimetry systems. The calibration of these calorimetry systems provides the basis for an accurate measurement of the power associated with the radioactive decay of isotopes of plutonium and their daughters. This power can be combined with a knowledge of the relative radionuclidic abundances to quantitatively determine the plutonium content of the material. The document also presents assigned half-lives and the related specific power constants of common isotopes of plutonium and mass 241 americium. 20 references. (auth)

17247 PERFORMANCE, TESTING, AND PROCEDURAL SPECIFICATIONS FOR THERMOLUMINESCENCE DOSIMETRY (ENVIRONMENTAL APPLICATIONS). ANSI-N545-1975. New York; American National Standards Institute, Inc. (1975). 16p. (ICONS-02093).

This standard specifies performance criteria for thermoluminescence dosimetry (TLD) systems used for the measurement of environmental exposure levels of X- and gamma radiation. Specifications are given for obtaining acceptable overall measurement uncertainties. (auth)

17248 FREE-AIR IONIZATION CHAMBER FOR THE ENERGY RANGE 12 keV TO 100 keV. Chartier, J. L. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Service Technique d'Etudes de Protection et de Pollution Atmospherique); Bazoge, A.; Itie, C. (Laboratoire Central des Industries Electriques (LCIE), 92 – Fontenay-aux-Roses (France)). Nucl. Instrum. Methods; 128: No. 2, 251-259(1 Oct 1975).

This article describes the design of a free-air ionization chamber intended for exposure measurements in X-ray and γ-ray beams ranging in energy from 12 to 100 keV. A summary is provided of a simplified operating theory for this type of chamber featuring electrodes perpendicular to the radiation beam, enabling a forecast of its essential characteristic, the spectral sensitivity curve. A description is given of a prototype chamber. The experimental results obtained show that this type of ionization chamber provides a precise determination of exposure. (NL)

Nuclear Spectroscopic Instrumentation

17249 (LYCEN-7535) REAL-TIME SUBSYSTEM IN NUCLEAR PHYSICS. Use of a Terminal Unit for Automatical Control of Experiments. Chatain, D. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire; Lyon-1 Univ., 69 (France)). 1975. 101p. (In French). INIS.

A data processing system allowing data acquisition and the automatic control of spectrometry experiments has been designed and installed at the Institut de Physique Nucleaire of Lyon. This system consists of a CDC 1700 computer used by the computing center as a terminal of the IN2P3 CDC 6600 computer and to which a remote station located near the experiment has been connected. Peripherals for spectrometer control and a display are connected to the remote station. This display makes it possible for users to converse with the computer and to visualize the spectra processing under a graphic or alphanumerical form. The software consists of a real time subsystem of the standard CDC system: "Mass Storage Operating System". This real time subsystem is meant to achieve data transfers between the computer and its remote station. A dynamic store allocation simulating a virtual memory is attached to the system. It allows the parallel running of many programs, no matter how long they are. Moreover a disk file supervisor allows experimenters to store experimental results for delayed processing. (FR)

17250 (ORNL-5046, pp 75-78) DOSIMETRY FOR TERRESTRIAL GAMMA-RAY SOURCES. Abdullah, S. A.; Dickson, H. W.; Kerr, G. D.; Miah, M. F. K.; Perdue, P. T. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Dose rates from natural radionuclides and ^{137}Cs in soils of the Oak Ridge area have been determined from in situ and core sample measurements. Information on soil composition, density, and moisture content and on the distribution of cesium in the soil was obtained from the core samples. Measurements of radionuclide concentrations in the samples were made with a 4 x 4 in. NaI detector. Gamma-ray spectroscopy using a lithium-drifted germanium (GeLi) detector has been applied to the determination of radionuclide concentrations in soil and the associated gamma dose rates above the earth plane. An unshielded GeLi detector placed about 1 m above the earth detects gamma radiation from an area of about 100 m^2. The equipment and data processing procedure are briefly described. (WHK)

17251 TRACE-ELEMENT ANALYSIS BY CHARGED-PARTICLE-INDUCED X RAYS. Badica, T.; Ciortea, C.; Constantinescu, F.; Petrovici, A.; Popescu, I. (Inst. for Atomic Physics, Bucharest). Newsletter on the Application of Nuclear Methods in Biology and Agriculture; No. 3, 37-38(Nov 1974).

17252 SIMPLE METHOD FOR THE DIFFERENTIAL COUNTING OF ^{14}C AND ^{32}P USING A POLYETHYLENE MINI VIAL. Noble, R. C.; Shand, J. H. (Hannah Research Inst., Ayr, Eng.). Newsletter on the Application of Nuclear Methods in Biology and Agriculture; No. 4, 3-4(May 1975).

17253 SOME STUDIES OF REFLECTOR CONSTRUCTION AND ELECTRONICS CONFIGURATIONS FOR OPTIMIZING PULSE-HEIGHT AND PULSE-SHAPE RESOLUTION IN ALPHA LIQUID-SCINTILLATION SPECTROMETRY. McKlveen, J. W. (Arizona State Univ., Tempe); McDowell, W. J. Nucl. Technol.; 28: No. 1, 159-164(Jan 1976).

Various sample sizes, reflector sizes and shapes, and reflector materials were examined to determine their effect on pulse-height and pulse-shape resolution in alpha liquid-scintillation spectrometry. A section of a metal sphere coated with a diffuse-white reflective material was found to have the best characteristics for both pulse-height and pulse-shape resolution. Although sample volumes as large as 10 ml could be tolerated when used with reflectors to accommodate them, the best results were obtained with 1-ml samples and smaller reflectors. Comparison of two types of pulse-shape discrimination circuitry for separating alpha and beta-gamma pulses indicated that a zero-crossover method was superior to a constant fraction timing method. The combination of these improved detectors with solvent extraction methods of incorporating the sample in the scintillator and pulse-shape discrimination allows alpha spectrometry with a background as low as 0.01 count/min and an energy resolution as high as 5.5 percent. (auth)

17254 SCATTERED GAMMA-RAY REGISTRATION CHANNEL FOR NUCLEAR GAMMA-RESONANCE SPECTROMETER. Babikova, Yu. F.; Gryaznov, M. R.; Isakov, L. M.; Kolpakov, N. S.; Uspenskii, M. N. (Moscow Engineering-Physics Inst.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 850-853(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 152-155(1975).

The scattered γ-ray registration channel for an NGR spectrometer operating with ^{57}Fe is described. It uses a shape discrimination circuit for pulses from a proportional counter. By using this channel it is possible to gain a five-fold reduction of background when registering scattered radiation with $E_\gamma = 6.3$ keV; in scattering geometry this permits NGR spectra to be obtained for specimens with a natural content of resonance isotope at a relatively short exposure time. (auth)

17255 MAGNESIUM WINDOWS WITH A MINIATURE INDIUM SEAL FOR MOESSBAUER HELIUM CRYOSTATS. Godovikov, S. K.; Snigirev, V. G. (Moscow State Univ.). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 970-971(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 243-244(1975).

It is proposed that the strong and corrosion-resistant magnesium alloy MA-8 which contains practically no Fe impurities be used for the windows of Moessbauer helium cryostats containing a heat-exchange gas that absorbs little γ-radiation. The thickness of the window is 0.1 mm which produces a reduction of 12.5% for 14.4 keV ^{57}Fe radiation and 3.2% for 23.8 keV ^{119}Sn radiation. A compact (dimensions not exceeding 35×6 mm) construction of windows based on an In seal without the use of bolts is likewise proposed. (auth)

17256 CHARACTERISTICS OF RANDOM-SUM PEAKS IN NUCLEAR RADIATION SPECTRA. Blatt, S. L. (Ohio State Univ., Columbus (USA). Dept. of Physics). Nucl. Instrum. Methods; 128: No. 2, 277-281(1 Oct 1975).

The spectrum of pulse heights resulting from the pile-up of constant-amplitude pulses, randomly distributed in time, is discussed. The shape of the pile-up spectrum is sensitive in differing degrees to the various time constants involved in detection and electronic processing. Predictions are presented for n-pulse pile-up, including a formula for two-pulse summation which differs significantly from the usually quoted result. Experimental data, utilizing a pulse generator operating with random time intervals down to 8 ns, agree with the predictions. (NL)

17257 SIMPLE METHOD FOR PEAK AREA DETERMINATION OF DOUBLETS. Knoth, J.; Schwenke, H. (Gesellschaft fuer Kernenergieverwertung in Schiffbau und Schiffahrt m.b.H., Geesthacht-Tesperhude (F. R. Germany). Inst. fuer Physik). Nucl. Instrum. Methods; 128: No. 2, 359-362(1 Oct 1975).

The proposed method is an expansion of the summation method for doublets of peaks with equal width. The mutual influence of the peaks is taken into account by a correction function depending on the response function of the spectrometer. A particular application is the evaluation of routine measurements, where similar spectra are recorded at high rates without changing the electronic adjustment. The method is restricted to doublets with a mutual distance of more than 1.5 fwhm and an intensity ratio down to about 1:10. (NL)

17258 RADIOACTIVITY OBSERVED IN THE SODIUM IODIDE GAMMA-RAY SPECTROMETER RETURNED ON THE APOLLO 17 MISSION. Dyer, C. S.; Trombka, J. I.; Schmadebeck, R. L.; Eller, E. (National Aeronautics and Space Administration, Greenbelt, Md. (USA). Goddard Space Flight Center); Bielefeld, M. J. (Computer Sciences Corp., Las Vegas, Nev. (USA)); O'Kelley, G. D.; Eldridge, J. S.; Northcutt, K. J. (Oak Ridge National Lab., Tenn. (USA)); Metzger, A. E. (Jet Propulsion Lab., Pasadena, Calif. (USA)); Reedy, R. C. (Los Alamos Scientific Lab., N. Mex. (USA)). Space Sci. Instrum.; 1: No. 3, 279-288(Aug 1975).

In order to obtain information on radioactive background induced in the Apollo 15 and 16 gamma-ray spectrometers (7 cm x 7 cm NaI) by particle irradiation during spaceflight, an identical detector was flown and returned to earth on the Apollo 17 mission. The induced radioactivity was monitored both internally and externally from one and a half hours after splashdown. When used in conjunction with a computation scheme for estimating induced activation from calculated trapped proton and cosmic-ray fluences, these results show an important contribution resulting from both thermal and energetic neutrons produced in the heavy spacecraft by cosmic-ray interactions. (NL)

17259 LORENTZ FACTOR FOR TRIPLE-AXIS SPECTROMETERS. Pynn, R. (Brookhaven National Lab., Upton, N. Y. (USA)). Acta Crystallogr., Sect. B; 31: No. 10, 2555-2556(15 Oct 1975).

An expression for the Lorentz factor relevant to a triple-axis neutron spectrometer is presented. The expression relates the structure factor of a Bragg peak to the integrated intensity obtained with any scan which passes through the Bragg point and which follows a linear path in reciprocal space. The important exact result obtained here is that the Lorentz factor is the same for double-axis spectrometers when theta-2 theta scan is used and when the sample is a single crystal with a narrow mosaic. (NL)

High Energy Physics Instrumentation

Refer also to abstracts 17725, 18495, and 19277.

17260 (FRNC-TH-576) TRIGGER SYSTEM FOR BARYON EXCHANGE STUDY BY IDENTIFICATION OF A PROTON IN OMEGA SPECTROMETER. Thenard, J. M. (Paris-11 Univ., 91 – Orsay (France)). 1974. vp. (In French). INIS.

Baryon exchange reactions with forward production of a proton are studied by the fast proton experiment with the spectrometer Omega. The triggering system for the experiment is examined here and the results obtained while developing a set of proportional chambers used in this system are given. (FR)

17261 (LAL-RI-74-1) CYLINDRICAL MULTIWIRE PROPORTIONAL CHAMBERS WITH ANODIC AND CATHODIC DETECTION: DEVELOPMENT AND TESTS OF A PROTOTYPE. Grosdidier, G. (Ecole Normale Superieure, 91 – Orsay (France). Lab. de l'Accelerateur Lineaire; Paris-11 Univ., 91 – Orsay (France)). Feb 1974. 120p. (In French). INIS.

A magnetic detector using 4 of these chambers is to be set up on the Orsay Storage Rings (ACO) in order to study the following experimental program: π form factor from E = 0.5 to 1.1 GeV; ρ-ω interference in 2π channel; branching-ratio for the decay modes of Φ; perhaps ρ-Φ (2π channel) and ω-Φ (3π channel) interferences. Inside of this detector, the 4 MWPC will be arranged with their axes parallel to the beams, and the solenoid gives a uniform magnetic field of 1 tesla also parallel to the beams. A detailed description of a prototype chamber is shown. It mentions: geometrical, mechanical and electrical specifications, building techniques, performances and detection efficiency (with a summary description of associated electronics). (FR)

17262 (LAL-RI-75-1) OPERATION OF A PROTON RECOIL DETECTOR USED TO MEASURE THE π-p ELASTIC CROSS SECTION AT 17.2 GeV. Callot, O. (Ecole Normale Superieure, 91 – Orsay (France). Lab. de l'Accelerateur Lineaire; Paris-11 Univ., 91 – Orsay (France)). Mar 1975. 44p. (In French). INIS.

The operation of a recoil proton detector is described; this detector is composed of multiwire proportional chamber planes

and scintillator stacks. The means to control the apparatus and the reaction which it measures are explained first, then the method used to measure the recoil proton energy, using simultaneously range and observation of energy loss, is described. This method allows obtaining a good accuracy while being rather insensitive to background. Finally a new measurement of the π-p elastic cross section at 17.2 GeV is given which is parametrized by $d(\sigma)/dt = Ae^{bt}$, the values of A and b are $A = 34.1 \pm 3mb$; $b = 8.13 \pm 0.15$ $(GeV/c)^{-2}$. (FR)

17263 (LAL-RI-75-5) PROBLEMS APPEARING DURING PARTICLE IDENTIFICATION USING THE CHERENKOV EFFECT. Efficiency of the Triggering System Used in the Fast Proton Experiment with the Omega Spectrometer. Roudeau, P. (Ecole Normale Superieure, 91 – Orsay (France). Lab. de l'Accelerateur Lineaire; Paris-11 Univ., 91 – Orsay (France)). Jun 1975. 111p. (In French). INIS.

The fast proton experiment has been realized in June 1974 at CERN upon the Omega spectrometer. The baryonic exchange reactions which have been studied are mainly determined by the emission of a forward fast-proton for instance $\pi^- p \rightarrow p + x$. The triggering of all the detectors was done after identification of this proton by using the Cherenkov effect and a matrix which was able to select a range of momentum. The problems of acceptance for the series of protons necessary for a correct study of the reactions involved are presented. The collection of Cherenkov light has set new problems of geometrical spreading; they have been studied in order to define the optical part of the Cherenkov counter. The operation and performance of this counter have also been indicated with those of the set of apparatus used in the detection and the identification of the fast-proton track. For this purpose proton-proton reactions were considered. Magnetic tapes of the output of the pattern recognition program (ROMEO) have been used. The number of events obtained in some part of the phase-space have been compared to the number calculated with the cross-sections coming from inclusive data. With these results the acceptance of the system has been calculated for some slow tracks using the data of proton-proton elastic scattering. (FR)

17264 (ORNL/TM-5162) CALCULATED RESPONSE OF A LIQUID-SCINTILLATOR TOTAL-ABSORPTION HADRON CALORIMETER. Santoro, R. T.; Amburgey, J. D.; Gabriel, T. A. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 19p. Dep. NTIS $5.00.

The calculated performance of a large-volume, all-liquid-scintillator calorimeter for incident pions having momenta in the range of 3 to 20 GeV/c is presented. The calculated scintillation pulse-height distribution, energy deposition, leakage energy, and pulse-height resolution as a function of pion energy are given. Calculated and experimental pulse-height distributions are compared for 20-GeV/c incident pions. (auth)

17265 DETECTOR OF RECOIL NUCLEI STOPPING IN SPARK CHAMBER GAS. Aleksanyan, A. S.; Zhirova, L. A.; Ivanov, V. A.; Kayumov, F. F.; Mkrtchyan, G. G.; Pikhtelev, R. N. (Erevan Inst. of Physics). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 10: No. 3, 196-200(1975). (In Russian)

A description is given of the detector for the registration of recoil nuclei which consists of a combination of drift and wide-gap spark chambers. It is shown that at appropriate discrimination the detector identifies recoil nuclei in the intensive electron and γ-beams with high efficiency ($\sim$100%). (auth)

17266 PRACTICABLE DISCRIMINATION OF RAPIDLY MOVING ELECTRIC AND MAGNETIC CHARGES. Hagstrom, R. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). Phys. Rev. Lett. 35: No. 25, 1677-1678 (22 Dec 1975).

A method of discriminating between rapidly moving electric and magnetic charges is proposed. The scheme relies on detection of the polarization of Cherenkov radiation. (auth)

17267 APPLICATION OF CLASSICAL THEORY OF ELECTRONS IN GASES TO DRIFT PROPORTIONAL CHAMBERS. Palladino, V. (European Organization for Nuclear Research, Geneva (Switzerland)); Sadoulet, B. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Nucl. Instrum. Methods; 128: No. 2, 323-335(1 Oct 1975).

It is shown that it is possible to understand both qualitatively and quantitatively, in the framework of the classical theory of electrons in gases, the behavior of drift velocities in gases commonly used in proportional drift chambers. Argon-isobutane mixtures are studied in detail and the contribution of diffusion to the spatial resolution and the modification of drift velocities in magnetic fields are especially commented on. (NL)

17268 VISUALIZATION IN THREE DIMENSIONS OF MEASURED DATA FROM BUBBLE CHAMBER PHOTOGRAPHS. Robinson, C. J.; Negus, P. J. (Glasgow Univ. (UK). Dept. of Natural Philosophy). Nucl. Instrum. Methods; 128: No. 2, 405-406(1 Oct 1975).

The authors, investigating the failure in geometry of some events measured by POLLY, determined whether measured data could be used with a stereoscopic viewer and be seen in three dimensions. (NL)

Radiometric Instruments

Refer also to abstract 16584.

17269 (IEA-398) MEASUREMENT OF HUMIDITY IN IRON ORES IN FREIGHT CARS BY NUCLEAR TECHNIQUES. Castagnet, A. C.; Said, M.; Duarte, U. (Instituto de Energia Atomica, Sao Paulo (Brazil)). Jul 1975. 30p. (In Portuguese). Dep. NTIS (US Sales Only) $4.00.

The methodology and the results of an experimental study, aimed to establish the possibility and the advantages of using a nuclear technique for measuring on the spot (in the freight cars) moisture content of iron ores are described. The measurements included the determination of both the volumetric moisture content and the density. From these values, the moisture content in percentage by weight, was calculated. For this purpose, a Nuclear Chicago d/M Combination Density-Moisture Probe with a 5 mCi Ra/Be source, and a digital portable scaler, were used. Two types of measurements were made: a straight one, placing the probe against the ore surface, and the other, across the freight car walls that consisted of steel plates, $\frac{5}{16}$" thick. Gravimetric determinations of moisture were parallelly made in both cases, with samples taken from the same ore volumes involved in the nuclear measurements. The values of the moisture content in percentage by weight obtained from the application of both methods, the nuclear and the gravimetric, were correlated for each type of measurement and processed in a H. P. Mod. 9810 A calculator, for quantitatively establishing the "goodness of fit" between the experimental data, and an equation determined by a linear regression. (auth)

17270 CRITICAL STUDY OF β-GAUGING FOR WATER CONTENT VARIATION MEASUREMENT IN PLANT LEAVES. Challa, H. (Centre for Plant Physiological Research, Wageningen, Netherlands); Hopmans, P. A. M.; de Swart, J. G. Newsletter on the Application of Nuclear Methods in Biology and Agriculture; No. 4, 9-12(May 1975).

The smallest changes in leaf thickness which can be observed in 15 $mg.cm^{-2}$ thick leaves, are changes of 0.13 $mg.cm^{-2}$, when using a GM tube as a detector in a β-gauge set-up in combination with a ^{99}Tc β source. Large changes in air temperature and air pressure will influence the measurements at this accuracy level due to changes in air density. It is possible to increase sensitivity by increasing countrate using a surface barrier detector. Growth of leaves and dry matter accumulation in the leaves may, however, interfere so strongly with these measurements that it makes this higher accuracy useless. Also it should be noticed that at increased sensitivity, influence of the environment on the measurement has to be taken into account. (NL)

17271 RADIOMETRIC MEASURING PROCEDURE FOR THE CONTROL OF DESTONING IN CHERRIES. Frank, A. (Bundesforschungsanstalt fuer Lebensmittelfrischhaltung, Karlsruhe, Ger.). Newsletter on the Application of Nuclear Methods in Biology and Agriculture; No. 3, 30-31(Nov 1974).

17272 DETERMINATION OF THE REAL PARTICLE SIZE FROM RADIOGRAPHIC SPOT DIAMETERS. Hirling, J. (MTA Izotop Intezete, Budapest). Izotoptechnika; 18: No. 6-7, 281-294(1975). (In Hungarian)

Calibration radiograms by means of radioactive metallic particles, produced by vapour condensation and classified by centrifuge are described. Measurement of spot diameter with particle size analyzer or microdensitometer and the plotting of the RDB diagram as a function of diameter, for the characterization of spot size distribution are discussed. (auth)

Radiation Effects on Instrument Components, Instruments, or Electronic Systems

Refer also to abstract 17057.

17273 (AD/A-007618) TOTAL-DOSE RADIATION-HARDENED COS/MOS INTEGRATED CIRCUITS. Annual Report, 8 October 1973–31 December 1974. Cohen, S. (RCA Solid State Div., Somerville, N. J. (USA)). 14 Mar 1975. Contract N00014-74-C-0079. 29p. (PRRL-75-CR-16). NTIS $3.75.

The work on radiation-hardened COS/MOS integrated circuits described in this report was done in two phases. Under Phase I, work was done to evaluate the effects of various SiO_2 channel-oxidation techniques on the radiation susceptibility of bulk-silicon and SOS COS/MOS circuits. Procedures for ion-implanting of aluminum in channel oxide and for evaluating characteristics that could be used to predict the radiation hardness of processed wafers were performed. Under Phase II, emphasis has been placed on developing techniques for improving the radiation hardness of COS/MOS circuits on sapphire substrates, and radiation-hardened COS/MOS-on-bulk-silicon integrated circuits were produced. Summaries of the various experimental processes are included. (GRA)

17274 (AD/A-007911) PROTECTION INSTRUCTIONS, EMP/RFI PROTECTION INFORMATION: USAEDH HARDNESS PROGRAM, EMP, SAFEGUARD GROUND FACILITIES, GRAND FORKS. Volume I. (Black and Veatch Consulting Engineers, Kansas City, Mo. (USA)). Dec 1974. Contract DACA87-74-C-0012. 178p. NTIS $7.00.

Protection instructions covering techniques applicable to the protection of tactical ground facilities from the effects of electromagnetic pulses (EMP) resulting from a nuclear explosion, and from radio frequency interference (RFI) generated by plant equipment or by external sources are presented. The protection instructions are based on the most recent authoritative data on EMP/RFI environment. (GRA)

Miscellaneous Instruments

Refer also to abstracts 17155, 17718, 17897, 19597, and 19614.

17275 (CNLM-6210) SUMMARY OF PLUGGING METER DESIGN AND OPERATING DATA. Woodward, C. E. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 1956. Contract AT(30-1)-2789. 10p. Dep. NTIS $3.50.

The use of plugging meters to determine oxide content in liquid metal test loops at Pratt & Whitney Aircraft-CANEL has been limited and the only experience has been with NaK. Two designs of such instruments are presented along with the available operating data. (WHK)

17276 (IRI-132-74-05) WAY OF TESTING THE REPEATABILITY OF NEUTRON DIFFRACTION RUNS. van Tricht, J. B. (Interuniversitair Reactor Instituut, Delft (Netherlands)). Oct 1974. 9p. INIS.

A system of statistical interferences enabling the judgement of repeated series of neutron diffraction measurements has been introduced. Use is made of the run test, the number of positive and negative deviations from the average is obtained for each series, and the number of runs determined. The number of runs is tested against the population mean and standard deviation. In order to treat diffraction measurements in this way, the procedure RUNTAL has been written. (NL)

17277 LLL STREAK CAMERA (15 AUG 1974) (ENGINEERING MATERIALS). (California Univ., Livermore (USA). Lawrence Livermore Lab.). (CAPE-524(Rev.)).

17278 PREAMPLIFIER: CHARGE OR CURRENT SENSITIVE, DIRECT COUPLED, FOR GENERAL PURPOSE COUNTING (4 JUN 1975) (ENGINEERING MATERIALS). (California Univ., Livermore (USA). Lawrence Livermore Lab.). (Cape-2412).

17279 SPACECRAFT POTENTIAL CONTROL AND PLASMA DIAGNOSTIC USING ELECTRON FIELD EMISSION PROBES. Grard, R. J. L. (European Space Research and Technology Centre, Noordwijk (Netherlands)). Space Sci. Instrum.; 1: No. 3, 363-376(Aug 1975).

A new probe is proposed to prevent spacecraft with conductive surfaces which are immersed in energetic plasma environments, from reaching highly negative potentials in case of insufficient photoelectron emission. This probe works on the principle of electron field emission; it is cheap, small in size, light in weight and it uses no power. Information about density and temperature of the surrounding plasma can even be obtained at the cost of very little additional hardware. It is recommended to mount this probe on spacecraft which are venturing in planetary magnetospheres, as a guarantee against failures of subsystems and experimental equipment caused by very negative surface potentials. (NL)

17280 ELECTRONICS FOR A SPUTTER ION MASS SPECTROMETER. Ruedenauer, F. G.; Schoeberl, E.; Prager, L.; Silberbauer, G. (Oesterreichische Studiengesellschaft fuer Atomenergie G.m.b.H., Seibersdorf. Elektronikinstitut). Nucl. Instrum. Methods; 128: No. 2, 309-313(1 Oct 1975). (In German)

An electrical control system for a sputter ion mass spectrometer is described. Manual or computer controlled operation of the digital and proportional programmable, high-voltage power supplies is possible. (NL)

ISOTOPE AND RADIATION SOURCE TECHNOLOGY

Refer also to abstract 17898.

Isotope Separation (Industrial)

Refer also to abstracts 16983 and 17169.

17281 (AED-CONF-75-340-001) THE URANIUM SUPPLY FOR THE FEDERAL REPUBLIC OF GERMANY. Oboussier, F. (Commission of the European Communities, Brussels (Belgium). Supply Agency). 1975. 24p. (In German). INIS.

From 45th colloquium on problems of energy legislation; Koeln, F. R. Germany (3 Jul 1975).

Available from ZAED.

A chronological survey is given on the development of toll enrichment which has until now been characterized by an USAEC enrichment monopoly. The development and background of the necessary contracts and agreements are described. The characteristics of the toll enrichment agreements with ERDA, URENCO, EURODIF, and TECHSNAB-Export are discussed. Finally, an outlook is given on the future possibilities of natural uranium supply. (DE)

17282 (CONF-740341-P2, pp vp Paper 14) URANIUM ENRICHMENT PROGRAM. O'Brien, J. G. 1974.

From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).

In 1974 electric utility engineering conference. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).

Westinghouse's involvement in the field of uranium enrichment is discussed. The gaseous diffusion and gas centrifuge processes are covered. The Cascade Improvement Program is briefly covered. (LK)

17283 URANIUMVERRIJKING. (Uranium Enrichment). Boskma, P.; Smit, W.; de Vries, G. Enschede, Netherlands; Technische Hogeschool Twente (1975). 154p.

This report is a collection of chapters each outlining a different aspect of uranium enrichment. These include different technological procedures for enrichment with specific attention on: the Netherlands' ultracentrifuge; the market and economic situation; political and social implications as well as environmental problems; the history and decision-making at the governmental level which led to the treaty of Almelo; regional aspects; and finally a state-of-the-art evaluation. The report was composed solely on publicly available data. (NL)

17284 DYE-LASER-INDUCED SEPARATION OF NITROGEN AND CARBON ISOTOPES. Karl, R. R. Jr.; Innes, K. K. (Department of Chemistry, State University of New York, Binghamton, New York 13901, USA). Chem. Phys. Lett.; 36: No. 3, 275-279(15 Nov 1975).

A unimolecular, laser-induced dissociation reaction of s-tetrazine ($C_2H_2N_4$), with a quantum yield of close to unity, was used to separate nitrogen 14/15 and carbon 12/13 isotopes. The sharp Q-branch of the 0-0 band of the 5515 A absorption system of tetrazine was irradiated for 1 minute periods with a 10 mW cw tunable dye laser output that was monochromatic to about 0.05 A. Each of the decomposition products, found here to be HCN and N_2, as well as the starting material, could be altered in isotopic composition, in either direction, by selection of an appropriate laser wavelength. The largest one-step enrichment ratio measured was 72. It makes possible mass separation at an efficiency of 17 moles per kWh of laser energy. (NL)

17285 METHOD FOR THE SELECTIVE EXCITATION OF MOLECULES BY THE RADIATION EMITTED FROM A LASER WITH AN ABSORPTION CELL IN ITS RESONATOR. Ambartsumyan, R.V.; Letokhov, V.S.; Maksimov, S.A.; Mishin, V.I.; Furzikov, N.P. (Institute of Spectroscopy, Academy of Sciences of the USSR, Akademgorodok, Moscow Province). Sov. J. Quantum Electron. 5: No. 8, 1018-1019 (Aug 1975).

Separation of the H, C, and O isotopes was achieved by the excitation of glyoxal ($H_2C_2O_2$) vapor with the radiation emitted from a pulse laser whose resonator contained an absorption cell filled with an $H_2C_2O_2$ dye. (auth)

17286 DIRECT OBSERVATION OF THE NONEQUILIBRIUM EXCITATION OF HIGH VIBRATIONAL LEVELS OF THE OsO_4 MOLECULE BY A HIGH-POWER LASER PULSE, AND SEPARATION OF OSMIUM ISOTOPES. Ambartsumyan, R.V.; Gorokhov, Yu.A.; Letokhov, V.S.; Makarov, G.N. (Spectroscopy Institute, USSR Academy of Sciences). JETP Lett. 22: No. 2, 43-44 (20 July 1975).

Nonequilibrium population of the vibrational levels $v \geq 10$ was revealed by the change of the vibrational structure of the UV spectrum following the action of a high-power CO_2 laser pulse on the OsO_4 molecule. A 15% enrichment of the osmium isotopes was obtained from the action of a strong IR field. (auth)

17287 ISOTOPE SEPARATION IN CHEMICAL REACTIONS OF VIBRATIONALLY EXCITED MOLECULES. Gordiets, B.F.; Mamedov, Sh.S. (P. N. Lebedev Physics Institute, Academy of Sciences of the USSR, Moscow). Sov. J. Quantum Electron. 5: No. 9, 1082-1084 (Sept 1975).

The vibrational distribution functions are analyzed theoretically for a binary mixture of diatomic gases modeled by anharmonic oscillators. It is assumed that the conditions are far from equilibrium. The results are used to calculate the isotope separation coefficient for chemical reactions involving vibrationally excited molecules. It is shown that far from equilibrium the separation coefficient is no longer an exponential function of the ratio of the activation energy to the gas temperature but depends only on the nonequilibrium store of the vibrational energy of the system. (auth)

17288 TRISTAN ON-LINE ISOTOPE SEPARATOR FACILITY. McConnell, J. R.; Talbert, W. L. Jr. (Iowa State Univ. of Science and Technology, Ames (USA). Dept. of Physics). Nucl. Instrum. Methods; 128: No. 2, 227-243(1 Oct 1975).

The TRISTAN facility consists of an isotope separator and associated nuclear spectroscopy equipment located at the Ames Laboratory Research Reactor. It is used for on-line studies of short-lived neutron-rich nuclides produced by fission of enriched ^{235}U. The facility is first described in terms of the target and neutron irradiation system along with the associated transport line. Next, the isotope separator is described with emphasis placed on developments of components for on-line operation, and results obtained from tests for mass purity. Ion beam handling to several detector stations through the use of a switching magnet is discussed along with a description of the stations. Also included are the design considerations of a moving tape collector and its drive electronics; retention measurements on tape material; control unit for time sequencing of beam, data accumulation, and tape transport; detector station for study of delayed neutrons; and a high-resolution pi root 2 beta-ray spectrometer. Some of the operational experiences over an eight-year period are discussed. (NL)

Isotopic Power Sources

17289 (AD/A-008086) MATCHING OF OUTPUT PARAMETERS OF RADIOISOTOPE THERMOELECTRIC GENERATORS. Malyshiv, A. Ya.; Ragozinskii, A. I.; Korotkov, N. P.; Dmitriev, A. I.; Sapelkin, B. P. Translated from Radiats. Tekh.; No. 6, 158-163(1971). 10p. (FSTC-HT-23-0209-75). NTIS $3.25.

The use of semiconductor constant voltage converters as matching devices satisfying the requirements of a number of users fed from a radioisotope thermoelectric generator is discussed. (GRA)

17290 (ORNL-5046, pp 239-246) NUCLEAR-POWERED CARDIAC PACEMAKERS. Shoup, R. L. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

The radiological hazards and benefit assessment of ^{238}Pu-powered cardiac pacemakers are analyzed. (TFD)

17291 (PB-239878) HYBRID THERMAL CONVERTER FOR AN ARTIFICIAL HEART DEVICE. Final Report, 1 July 1973–30 November 1974 on Phase 1. Lurie, H.; Boretz, J. E.; Wright, H. W. Jr.; Nezgoda, E.; Silver, A. (TRW Systems, Redondo Beach, Calif. (USA)). Nov 1974. Contract N01-HT-4-2900. 201p. (TRW-22646.000). NTIS $7.25.

The program consisted of the design and development of breadboard version of a Turbine Organic Rankine Engine System (TORES). This breadboard engine successfully demonstrated the capability of providing 5.2 W of output hydraulic power to the H-TAH blood pump using a simulated 50-W thermal heat source. This compares favorably with the required minimum 4.0 W hydraulic power output performance goal. The TORES engine utilizes a Pu-238 isotope heat source to provide the thermal energy for a turbine-driven hydraulic pump. The pump provides the required flows and pressure levels for both the thermodynamic

loop and the hydraulic control loop. Waste heat from the engine is initially rejected to the hydraulic loop flow and finally to the blood at the blood pump heat exchanger. (GRA)

Radiation Sources

17292 (UCRL-51860) PINHOLE FOR PRODUCING A CLOSE-IN IMAGE OF AN EXTENDED 14-MeV NEUTRON SOURCE. Matthews, S. M. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 1 Jul 1975. Contract W-7405-Eng-48. 50p. Dep. NTIS $4.00.

In pulsed-neutron pinhole imaging experiments, it is desirable to produce images of extended 14-MeV neutron sources close to the source itself to minimize time-of-flight distortions. "Close" means that the thickness of the pinhole barrier is not negligible in comparison with the distance from the source to the image plane. A pinhole assembly capable of producing close-in images extended 14-MeV neutron sources was designed and used in a number of experiments. A computer program was devised to predict the performance of the pinhole by calculating the distribution of neutrons incident on the image plane from a neutron point source in the source plane. The calculation of the image-plane neutron distribution takes into account edge penetration through the barrier and is a function both of the neutron mean free path in the barrier material and of the system geometry. (auth)

Industrial Uses

Refer also to abstracts 17323 and 17326.

17293 (AED-CONF-75-360-001) ON-STREAM ANALYSIS WITH CALIFORNIUM 252. Braun, H. (Kernforschungszentrum Karlsruhe (F. R. Germany). Lab. fuer Isotopentechnik). 1975. 26p. (IAEA/SR-3). INIS.

From IAEA seminar on the uses of californium 252 in teaching and research; Karlsruhe, F. R. Germany (14 Apr 1975).

Available from ZAED.

To develop methods of industrial process analysis an irradiation loop has been erected at the Laboratorium fuer Isotopentechnik of the Kernforschungszentrum Karlsruhe, which allows continuous irradiation of liquids by means of a 1 mg ^{252}Cf source. (DE)

17294 (SAND-75-0580) WASTE RESOURCES UTILIZATION PROGRAM. Progress Report, Period Ending September 30, 1975. (Sandia Labs., Albuquerque, N. Mex. (USA)). Dec 1975. Contract AT(29-1)-789. 29p. Dep. NTIS $4.00.

The purpose of the Waste Resources Utilization Program is to develop a technology to constructively couple two major environmental problems, disposition of human and nuclear waste, in an attempt to provide a framework in which both will become useful resources. Sludge treated with thermoradiation offers considerable potential for use as a fertilizer in agriculture or a soil conditioner for land reclamation free of the serious potential health hazards associated with conventional methods of land disposal. In addition, the very real possibility exists that treated sludge may provide a low-cost substitute for high-nutritional components in ruminant diets. The liter size flow-through system is put into operation for the first time and provides sufficient quantities of treated sludge for good biological analysis and to start the animal feeding program at New Mexico State University. Approximately 3800 gal of sewage sludge were thermoradiation-treated with the system. The sludge was exposed to approximately 150 krads of gamma radiation at a temperature of 65^{0}C. The treated sludge was monitored for elimination of total coliforms and fecal strep. No fecal strep bacteria were found in 400 sample plates; three contained coliform growth. An intensive study of poliovirus inactivation in sewage sludge was completed this quarter. Source efficiencies were calculated for possible modification to the WESF capsule which would consist of inserting a hollow tube in the center of the capsule. This was proposed as a simple modification to the standard WESF capsule to reduce the self-shielding characteristic of the cesium. The calculations showed little or no advantage of adding the center tube. (TFD)

17295 LEAK TESTING METHOD. (to Neratoom N. V.). Netherlands Patent 7,403,213/A/. 11 Mar 1974. 6p. (In Dutch)

A leak testing method with far greater sensitivity than the helium leak test is described. The diffusion of a neutron-activatable gas like argon or freon into the liquid-sealing material is measured. The concentration of the diffused gas as a function of time is measured by activation analysis with thermal neutrons. Argon is preferred because of its large neutron capture cross section. A sampling means is also described. (NL)

17296 STUDY OF INDIUM DIFFUSION INTO SILVER CHLORIDE MONOCRYSTALS USING TRACER TECHNIQUES. Frisch, J. Frankfurt; Frankfurt Univ. (1971). 50p. (In German). INIS. Thesis.

The diffusion of indium ions into pure and indium-doped silver chloride monocrystals was investigated in a temperature region of 300 to 400°C. The homogeneity of the pre-doping was investigated using the neutron activation analysis method. The "tracer technique" was used to carry out the experiments for the diffusion of indium into non-doped and indium pre-doped crystals. The diffusion of the indium tracer was done from an evaporated thin layer on the crystal. The concentration distribution of the indium ions in AgCl was determined using activity measurements. The concentration independence of the diffusion coefficients was obtained from the analysis of the measured data. By means of the temperature dependence of the D-values, the activation energy for the non-doped and indium pre-doped crystals was obtained using the Arrhenius equation. (DE)

LIFE SCIENCES

Radiation Effects on Biochemicals

17297 (CRSSA-1973, pp 21-22) LINOLEIC ACID, THYMINE, AND TRYPTOPHAN RADIOSENSITIZATION BY PROTOPORPHYRIN IN PRESENCE OF OXYGEN. Champel, P.; Mignot, M. A.; Pillement, B.; Fontenil, L.; Rocquet, G. [nd]. (In French).

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75 – Paris (France)).

Sensitizing effect induced by protoporphyrin, an active molecule in photooxidation, is studied. Studied substances are tryptophan, thymine, linoleic acid, each component representing one of the great groups of biological components, nucleic acid, proteins, lipids. (FR)

17298 (CRSSA-1973, pp 23-25) OXYGEN EFFECT AND EXCITATION ENERGY. Radiolysis of Tryptophan and Its N-Acetyl Derivative. Fontenil, L.; Delaire, J.; Bourgouin, A.; Voegele, C.; Rocquet, C. [nd]. (In French).

In Centre de Recherches du Service de Sante des Armees. 1973 Scientific Works. (Centre de Recherches du Service de Sante des Armees, 75–Paris (France)).

The physicochemical study of oxygen effect and the part played by excitation energy are described. The case of a model molecule of biological interest: tryptophan and its N-acetyl derivative is given. (FR)

17299 (MBL-1975-11) COMPARISON OF THE OXYGEN ENHANCEMENT RATIO FOR γ-RAY-INDUCED DOUBLE-STRAND BREAKS IN THE DNA OF BACTERIOPHAGE T7 AS DETERMINED BY TWO DIFFERENT METHODS OF ANALYSIS. van der Schans, G. P.; van der Drift, A. C. M. (Rijksverdedigingsorganisatie TNO, Rijswijk (Netherlands). Medisch Biologisch Lab. TNO). 1975. 19p. INIS.

Bacteriophage T7 was irradiated in a protecting medium under nitrogen and oxygen with ^{60}Co γ rays. Double-strand breaks were measured by sucrose gradient sedimentation and by boundary sedimentation analysis. Both methods showed that the presence of oxygen during irradiation enhances the production of double-strand breaks. This is in contrast to a recent report which suggests that boundary sedimentation analysis does not show the effect of oxygen. The discrepancy must be ascribed to differences in the interpretation of the sedimentation data. (NL)

17300 PHYSICO-CHEMICAL AND BIOLOGICAL STUDY OF EXCISION-REPAIR OF uv-IRRADIATED PHIX 174 FR DNA IN VITRO. Heijneker, H. L. pp 45-60 of Enzymes Involved in the Repair of DNA, Damaged by Ultraviolet Light. Leiden, Netherlands; Cohen (J. A.) Instituut voor Radiopathologie en Stralenbescherming (1975).

A study is presented on the excision repair of ultraviolet-irradiated PHIX 174 RFI DNA in vitro with uv-specific endonuclease from micrococcus luteus, DNA polymerase I from E. coli and DNA ligase from phage T4 infected E. Coli. Excision repair was measured by physicochemical and by biological methods. It is shown that more than 90% of the pyrimidine dimers can be repaired in vitro and that the repaired molecules have regained full biological activity. Endonuclease III was not essential for excision repair in vitro and did not stimulate repair; from this it was concluded that uv-endo generates 3′ OH endgroups. The usefulness of the methods with regard to the study of excision repair is discussed. (NL)

17301 COMPLEMENTING XERODERMA PIGMENTOSUM FIBROBLASTS RESTORE BIOLOGICAL ACTIVITY TO UV-DAMAGED DNA. Day, R. S. III; Kraemer, K. H.; Robbins, J. H. (National Institutes of Health, Bethesda, MD). Mutat. Res.; 28: No. 2, 251-255(May 1975).

UV survival curves of adenovirus 2 using fused complementing xeroderma pigmentosum fibroblast strains as virus hosts showed a component with an inactivation slope identical to that given by normal cells. This component was not observed when the fibroblasts were not fused or when fusions involved strains in the same complementing group. Extrapolation to zero dose indicated that three percent of the viral plaque-forming units had infected cells capable of normal repair; this suggested that three percent of the cells were complementing heterokaryons. Thus, heterokaryons formed from xeroderma pigmentosum fibroblasts belonging to different complementation groups are as capable of restoring biological activity to UV-damaged adenovirus 2 as are normal cells. (NL)

17302 EFFECT OF A MAMMALIAN REPAIR ENDONUCLEASE ON X IRRADIATED DNA. Tomura, T.; Van Lancker, J. L. (Univ. of California, Los Angeles). Biochim. Biophys. Acta; 402: No. 3, 343-350(1 Sep 1975).

DNA was extracted from rat liver of non-irradiated animals and was irradiated in vitro, and from animals that received whole-body doses of x radiation. Sedimentation of neutral and alkaline sucrose gradients as well as measurements of 32P release after sequential treatment with endonuclease and alkaline phosphatase and determination of triphosphate incorporation after the sequential treatment with endonuclease, alkaline phosphatase, and DNA polymerase indicated that DNA irradiated in vivo and in vitro were effective substrates for the mammalian repair endonuclease. The experiments suggest that in addition to strand breaks, x radiation causes base damage and they have provided a plausible explanation for the formation of double strand breaks in DNA irradiated in vivo. (NL)

17303 EFFECT OF RADIOTHERAPY ON THE HISTOCHEMISTRY OF NAD-H_2-AODF-H_2-DEHYDROGENASES AND LACTAT-DEHYDROGENASE IN HUMAN LARYNX CANCERS. Karas, A. F. Zh. Ushnykh Nosovykh Gorlovykh Bolez.; 3: 13-18(1974). (In Russian).

The tumour masses resected during laryngectomy in 25 patients were subjected to morphohistochemical analyses. It was found that the suppressing effect of radiotherapy on the metabolic activity of the cells of larynx malignant neoplasms lasts during a period of about 5 to 6 months after the end of the treatment. (auth)

17304 PHOTOREACTIVATION OF PYRIMIDINE DIMERS IN THE DNA OF NORMAL AND XERODERMA PIGMENTOSUM CELLS. Sutherland, B. M.; Oliver, R.; Fuselier, C. O.; Sutherland, J. C. (Univ. of California, Irvine). Biochemistry; 15: No. 2, 402-406(27 Jan 1976).

Photoproducts formed in the DNA of human cells irradiated with ultraviolet light (uv) were identified as cyclobutyl pyrimidine dimers by their chromatographic mobility, reversibility to monomers upon short wavelength uv irradiation, and comparison of the kinetics of this monomerization with that of authentic cis-syn thymine–thymine dimers prepared by irradiation of thymine in ice. The level of cellular photoreactivation of these dimers reflects the level of photoreactivating enzyme measured in cell extracts. Action spectra for cellular dimer photoreactivation in the xeroderma pigmentosum line XP12BE agree in range (300 nm to at least 577 nm) and maximum (near 400 nm) with that for photoreactivation by purified human photoreactivating enzyme. Normal human cells can also photoreactivate dimers in their DNA. The action spectrum for the cellular monomerization of dimers is similar to that for photoreactivation by the photoreactivating enzyme in extracts of normal human fibroblasts. (auth)

17305 SEPARATION OF CHROMATIN CONTAINING BROMODEOXYURIDINE IN ONE OR BOTH STRANDS OF THE DNA. Taichman, L.; Greedlender, E. F. (Univ. of Wisconsin, Madison). Biochemistry; 15: No. 2, 447-451(27 Jan 1976).

A method has been devised for the separation of chromatin containing 5-bromodeoxyuridine (BrUdRib) in one strand (HL) of the DNA from that with BrUdRib in both strands (HH). Ultraviolet light breaks chromatin containing HH DNA into smaller fragments than chromatin containing HL DNA and the two species can be partially resolved on neutral sucrose gradients. Unfiltered ultraviolet light is not suitable since it causes considerable alteration in the electrophoretic pattern of chromatin-associated proteins. Irradiation with 313-nm light causes much less damage to the associated proteins. The ability to separate, isolate, and examine chromatin containing HL and HH DNA makes studies on the distribution of chromatin-associated proteins possible. (auth)

17306 ROLE OF METAL IONS IN THE RADIOSENSITIVITY OF METALLOPROTEINS. Model Experiments With Bovine Carbonic Anhydrase. Redpath, J. L.; Santus, R.; Ovadia, J.; Grossweiner, L. I. (Michael Reese Hospital, Chicago). Int. J. Radiat. Biol.; 28: No. 3, 243-253(Sep 1975).

The radiation-induced inactivation of dilute solutions of three forms of bovine carbonic anhydrase (metal-free apo-BCA, Zn^{2+}-BCA, and Co^{2+}-BCA) has been studied. The presence of the metal ions did not alter the sensitivity of the enzyme to inactivation by oxidizing radicals; however, they exerted a protective effect against inactivation by reducing radicals. Data obtained using the amino-acid-specific inorganic radical anions $(CNS)_2^-$ and Br_2^- allowed the identification of histidine, tyrosine, and tryptophan as residues essential to the activity of bovine carbonic anhydrase when assayed by p-nitro-phenylacetate. (auth)

Radiation Effects on Cells

Refer also to abstract 17303.

17307 PRETHERAPEUTIC RESEARCH PROGRAMS AT π^- MESON FACILITIES. Skarsgard, L. D.; Palcic, B. (British Columbia Cancer Inst., Vancouver). Excerpta Med. Int. Congr. Ser.; 2: 447-454(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

17308 TUMOR CELL PROLIFERATION UNDER CONTINUOUS IRRADIATION. Fabrikant, J. I. (Hammersmith Hospital, London). pp 585-589 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A review is given of investigations on tumor cell proliferation kinetics under continuous irradiation and of factors governing the response of tumors growing in cultures as well as in rats and mice under very low dose rate exposure conditions. (NL)

17309 X-RAY AND UV-INDUCED CHROMATID ABERRATION: EVIDENCE FOR POLYNEMIC CHROMOSOMES. Bender, M. A. (Johns Hopkins Univ., Baltimore); Merz, T.; Bedford, J. S.; Griggs, H. G. Mutat. Res.; 28: No. 2, 191-197(May 1975).

Data from X-ray experiments are reported in which synchronized Chinese hamster tissue culture cells were irradiated in either G_1 or G_2 and then scored for chromatid aberrations in their first, second, and third post-irradiation mitoses. The results are compared with those reported by Ikushima and Wolff. It is concluded that all of the data available on aberration production is compatible with a mononeme model of eukaryote chromosome structure. This is in contrast with the conclusions of the two authors mentioned above. They interpreted their observation of chromatid aberrations in second and third mitoses following X radiation and the production of chromatid type chromosomal aberrations by UV light administered during the G_1 phase of the cell cycle in terms of a polyneme model of eukaryote chromosome structure. (NL)

17310 ESTIMATION OF LIFE TIMES AND DIFFUSION DISTANCES OF RADICALS INVOLVED IN X-RAY-INDUCED DNA STRAND BREAKS OF KILLING OF MAMMALIAN CELLS. Roots, R.; Okada, S. (Univ. of Rochester, NY). Radiat. Res.; 64: No. 2, 306-320(Nov 1975).

We have used a mammalian tissue culture system to calculate the life times and diffusion distances in DNA scissions as well as cell killing for the three main products of water radiolysis: OH, H, and e^-/sub aq/. Using various alcohols as radical scavengers, the average life time for OH in DNA single-strand breaks was calculated to be about 4×10^{-9} sec. Using the same data and published rate constants, the apparent life time of H atoms was calculated to vary from about 2×10^{-7} to 4×10^{-6} sec and, similarly, the calculated life time of the hydrated electron was found to vary more than was the case for OH. From these life times, the radical diffusion distances were estimated to be approximately 60 A for OH, which is reasonable, but the values for both H and e^-/sub aq/ were unrealistically large, i.e., 880 to 4040 A for H and 9590 to 19,810 A for e^-/sub aq/. In cell killing, the OH radical life time was estimated to be about 8.7×10^{-9} sec which gives an average diffusion distance for this radical of about 93 A. Our data support the idea that OH is the radical species primarily responsible for the indirect effect in radiation injury measured as DNA single-strand breaks or cell killing, and that H and e^-/sub aq/ are not significantly involved. (auth)

17311 RBE AS A FUNCTION OF NEUTRON ENERGY. I. Experimental Observations. Hall, E. J.; Novak, J. K.; Kellerer, A. M.; Rossi, H. H.; Marino, S.; Goodman, L. J. (Columbia Univ., New York). Contract AT(11-1)-3243. Radiat. Res.; 64: No. 2, 245-255(Nov 1975).

The survival of Chinese hamster cells in culture was used as a test system to determine the RBE of neutrons over a wide energy range. The Radiological Research Accelerator Facility (RARAF) at Brookhaven National Laboratory was used for experiments involving nine neutron energies between 110 keV and 15 MeV; for all but the lowest energy the beams were essentially monoenergetic. Additional experiments were performed with high energy cyclotron-produced neutrons at the Naval Research Laboratory, Washington, D. C., and at the Texas A and M Variable Energy Cyclotron (TAMVEC). In both cases broad neutron energy spectra were involved. In each experiment, survival curves were obtained for one neutron energy and compared with 250 kVp x rays, using cells from the same suspension and common controls. In this way a detailed study was made of the relation between RBE and neutron absorbed dose for each neutron energy. At any given cell survival level, RBE varies with neutron energy. Neutrons at 350 keV are biologically the most effective, the RBE falling off for both higher and lower neutron energies. (auth)

17312 EFFECT OF EXTREME HYPOXIA ON THE REPAIR OF DNA SINGLE-STRAND BREAKS IN MAMMALIAN CELLS. Koch, C. J.; Painter, R. B. (Univ. of California, San Francisco). Radiat. Res.; 64: No. 2, 256-269(Nov 1975).

About 20 percent of the single-strand breaks produced by x rays in V79 Chinese hamster cells under extremely hypoxic conditions remain unrepaired after 1 hr at 37°C. The corresponding figure is only 10 percent for cells irradiated under moderately hypoxic (0.2 mu M) or aerobic conditions (200 mu M). The initial number of breaks produced per unit dose is identical for extremely hypoxic and moderately hypoxic cells and is about four times greater for aerobic cells. Because split-dose recovery proceeds under aerobic and moderately hypoxic conditions and is inhibited only under extremely hypoxic conditions, the split-dose recovery phenomenon may be related to the unrepaired component of single-strand breaks. (auth)

17313 RADIOSENSITIZATION OF HYPOXIC MAMMALIAN CELLS BY DIAMIDE. I. Effects of Experimental Conditions on Survival. Harris, J. W.; Power, J. A.; Koch, C. J. (Univ. of California, San Francisco). Radiat. Res.; 64: No. 2, 270-280(Nov 1975).

Diamide sensitizes hypoxic mammalian cells to x radiation in a complex manner. It sensitizes CHO cells more effectively than V79-S171 cells and is far more efficient at 0°C than at 18°C in the presence of glucose. In the cold, diamide is more efficient than either nifuroxime or metronidazole (Flagyl), but this advantage is lost at 18°C. Low concentrations of diamide (40 to 100 mu M, depending on cell line) decrease the extrapolation number to or close to 1 while affecting the D_0 only slightly, but higher concentrations decrease the D_0 to the euoxic level. The single-dose survival of V79 cells irradiated in the presence of increasing diamide concentrations follows a biphasic curve, with a break in the region of 200 to 300 mu M. Since diamide is not inactivated by x radiation and since there is no evidence of differential sensitization of cells in M, G_1, late S, or plateau-phase G_1/G_0, we interpret these data to mean that diamide acts by at least two mechanisms, one operating mainly at low concentrations to reduce the shoulder and the other predominating at high concentrations to decrease the D_0. (auth)

17314 INACTIVATION OF CHINESE HAMSTER CELLS BY X RAYS: SYNCHRONIZED AND EXPONENTIAL CELL POPULATIONS. Gillespie, C. J.; Chapman, J. D.; Reuvers, A. P.; Dugle, D. L. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Radiat. Res.; 64: No. 2, 353-364(Nov 1975).

Reproductive survival of irradiated Chinese hamster fibroblasts is adequately described at all cell ages by an equation of the form S/S_0 equals exp (-alpha D - beta D^2). The two terms may be related to the likelihood of inactivation by one or two events, respectively. If the inactivating lesion involves damage to the genome, then corrections should be applied to all but G_1 phase cell populations to account for genome multiplicity. The appropriate corrections are derived. The corrections render the single event coefficient, alpha, constant through interphase, in agreement with data for high LET irradiation. The variations in the two parameters with cell age are clearly different, indicating that cyclic changes in radiosensitivity may not be related to any single physiological correlate, and suggesting that there may be mechanistic differences between the two components other than the number of events involved. Synthesized survival data representing an exponential population are well fitted by the same equation, as observed experimentally. (auth)

17315 INACTIVATION OF CHINESE HAMSTERS CELLS BY X RAYS: THE EFFECTS OF CHEMICAL MODIFIERS ON SINGLE- AND DOUBLE-EVENTS. Chapman, J. D.; Gillespie, C. J.; Reuvers, A. P.; Dugle, D. L. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Radiat. Res.; 64: No. 2, 365-375(Nov 1975).

The radiation inactivation of the proliferative capacity of Chinese hamster fibroblasts is described by the linear-quadratic relationship, S/S_0 equals exp (-alpha D - beta D^2). Values of alpha and beta have been determined for asynchronous cells irradiated under various conditions of chemical radioprotection and radiosensitization. OH has been found to contribute to cell inactivation by both alpha (single-events) and beta (double-events). Sulfhydryl repair was found to provide radioprotection against single- and double-events while molecular oxygen was found to radiosensitize predominantly by enhancing double-events. Electron-affinic radiosensitizers enhanced the double-event component. These radiation chemical effects on cell inactivation are discussed with reference to potential molecular targets and lesions and the microdosimetry of 250 kV x rays in water. (auth)

17316 INTRACELLULAR CYCLIC AMP LEVELS AND RADIOSENSITIVITY IN SYNCHRONIZED V-79 CELLS. Lehnert, S. (Columbia Coll. of Physicians and Surgeons, NY). Radiat. Res.; 64: No. 2, 394-398(Nov 1975).

Cyclic AMP was assayed in V-79 Chinese hamster lung cells at various times after synchronization by shake-off of mitotic cells. Highest concentrations were found 2 to 6 hr after synchronization (S phase), while lowest concentrations were in mitotic cells. x-ray survival curves were prepared at various times during the division cycle, and extrapolation number was found to be highest during the period when intracellular cyclic AMP level was at a maximum. Conversely, in mitotic cells where cyclic AMP concentration is at a minimum extrapolation number was 1. Survival curves prepared using cells in which intracellular cyclic AMP level was elevated by drugs are characterized by higher extrapolation number and lower D_0 than controls. It is postulated that changes in cyclic AMP during the division cycle may be one of the factors which produce the characteristic changes in radiation response observed as the cell traverses the cycle. (auth)

17317 EFFECT OF CELLS STERILIZED BY IONIZING RADIATION ON THE GROWTH OF CELLS L_{1210}. Malaise, E. P.; Detcheva-Ninova, Z.; Tubiana, M. (Institut Gustave-Roussy, Villejuif, France). C. R. Acad. Bulg. Sci.; 28: No. 3, 427-429 (1975). (In Bulgarian).

Male mice were exposed to 15,000 rads to completely kill the cells. Living L_{1210} cells either alone or accompanied by the sterilized cells were injected peritoneally or subcutaneously into mice previously exposed to 350 rad. After intraperitoneal injection the addition of sterilized cells prolong the survival time of mice subjected to no irradiation, but has no effect on the survival of irradiated mice. Subcutaneous injection of living cells increased the survival time of mice and the addition of sterilized cells, in some cases, prolonged the survival indefinitely. These results indicate that sterilized cells have both an inhibitory effect resulting in prolongation of survival and a stimulating effect which is not apparent after intraperitoneal injection. (JSR)

17318 CANCER-RELATED ASPECTS OF REGENERATION RESEARCH: A REVIEW. Donaldson, D. J.; Mason, J. M. (Univ. of Tennessee, Memphis). Growth; 39: No. 4, 475-496(Dec 1975).

Tissue regeneration is simply the replacement of lost cells of a tissue by those remaining. Epimorphic regeneration involves dedifferentiation of many tissues and their organization into a blastema which eventually differentiates into the missing part, usually an appendage. A detailed comparison of the cell membrane changes occurring in epimorphic regeneration, tissue regeneration and cancer can contribute to greater understanding of the differences between normal and tumor cells. Further, there is evidence that epimorphic regeneration fields may in some instances suppress tumor induction and control existing tumors. This influence may be mediated by bioelectric fields, which are ubiquitous in nature and appear to control many cellular events. Disruption of these bioelectric fields suppresses epimorphic regeneration and may lead to cancer in mammals, while applied electric fields alter regenerative events and cause tumor regression. Studies on x-radioinduced regeneration suppression in relation to mutagenesis are also reviewed. (HLW)

17319 COMPARATIVE STUDY OF POST-IRRADIATION GROWTH KINETICS OF SPHEROIDS AND MONOLAYERS. Dertinger, J.; Luecke-Huhle, C. (Kernforschungszentrum, Karlsruhe, Ger.). Int. J. Radiat. Biol.; 28: No. 3, 255-265(Sep 1975).

Post-irradiation growth kinetics of γ-irradiated spheroid and monolayer cells in exponential growth phase was investigated by means of dose-response curves based on cell counts after specified time intervals following irradiation. A mathematical model of cell-growth after irradiation was fitted to these curves. The model parameters (related to division delay and growth of non-surviving cells) obtained from this analysis consistently indicated increasing resistance to sub-lethal damage of cells cultured as multicellular spheroids under conditions of increasing three-dimensional contact. In contrast, no indication of an increased radiation-resistance was found with cells cultured on a substratum under a variety of conditions. (auth)

17320 RADIATION-INDUCED DECREASE IN INFLUX RATES OF POTASSIUM IONS INTO THYMOCYTES IN VITRO IN RELATION TO DECREASED INTRACELLULAR ADENOSINE TRIPHOSPHATE CONCENTRATIONS. Chapman, I. V.; Sturrock, M. G. (Dundee Univ., Eng.). Int. J. Radiat. Biol.; 28: No. 2, 155-163 (Aug 1975).

The relationship between decreases in the adenosine triphosphate content of irradiated thymocytes and observed changes in the influx constant values for potassium ions in the same cells have been investigated. The results suggest that radiation-reduced ATP concentrations may be a rate-limiting factor controlling the active transport of potassium, 3-4 hours after x-irradiation in the range 2-20 krad. However, over the first hour of incubation, post-exposure ATP levels have not decreased sufficiently to be a major factor in the observed decrease in active uptake of potassium ions. This evidence is supported by comparisons of the influence of 1 mM adenine on radiation-reduced ATP levels and influx constants over the first hour after irradiation. (auth)

17321 COMPARISON OF THE RADIOSENSITIVITY AND OER OF HUMAN AND MOUSE MARROW PROGENITOR CELLS CULTURED IN AGAR IN DIFFUSION CHAMBERS. Gordon, M. Y. (Inst. of Cancer Research, Sutton, Eng.). Int. J. Radiat. Biol.; 28: No. 3, 285-290(Sep 1975).

The agar diffusion chamber technique has been used to provide standard culture conditions for measurements of the effects of ^{60}Co gamma radiation, under well-oxygenated and hypoxic conditions on colony precursor cells in human and mouse marrow. The sensitivity of mouse femoral cells in situ was also used to give an indication of the relevance of measurements made on cultured cells to their response in vivo. Under identical conditions, human bone-marrow cells were found to be more radiosensitive (D_0 85.2 ± 4.5 rad) than mouse marrow colony forming cells (D_0 138.7 ± 4.8 rad). Mouse cells irradiated in chambers and in situ (D_0 137 ± 2.7 rad) did not differ in their radiosensitivity, indicating that the response of cells treated in diffusion chambers was not modified by culture conditions. The radiosensitivities of human (o.e.r. 1.96 ± 0.01) and mouse (o.e.r. 1.99 ± 0.06) bone-marrow colony-forming cells were modified to the same extent by changes in the oxygen tension, although these o.e.r. values were slightly lower than for mouse femoral cells in situ (o.e.r. 2.25 ± 0.10). These results are compared with those of other workers. (UK)

17322 MODIFICATION OF END-GROUPS IN DNA STRAND BREAKS OF IRRADIATED THYMOCYTES DURING EARLY REPAIR. Lennartz, M.; Coquerelle, T.; Hagen, U. (Kernforschungszentrum, Karlsruhe, Ger.). Int. J. Radiat. Biol.; 28: No. 2, 181-185(Aug 1975).

To test a proposed molecular mechanism of strand-break repair the nature of the end-groups in DNA of irradiated thymocytes was analysed in the course of early repair of strand breaks. For enzymatic end-group analysis, high irradiation doses up to some Mrad were necessary to obtain reliable results. Doses were selected, therefore, for which cell-death and reliability of the end-group determinations were tolerable. The results show some repair of the actual strand breaks even after interphase death within a few hours. Preferably those strand breaks are joined carrying 5′ phosphate and 3′ OH end groups. In addition, on the 3′ terminals of the other strand breaks some exonucleolytic action takes place. Complete repair is not observed. (UK)

Radiation Effects on Microorganisms

Refer also to abstracts 17294 and 17299.

17323 (EUR-ITAL-18) TECHNICAL AND ECONOMIC FEASIBILITY OF THE USE OF GAMMA RADIATION FOR DISINFECTION OF SEWAGE SLUDGE. Groneman, A. F. (Association Euratom-ITAL, Wageningen (Netherlands)). [nd]. 21p. INIS.

Disinfection of sewage sludge by ionizing irradiation has been well studied at the laboratory level in the last decades. The technical and economic feasibility is now being investigated at the pilot plant level near Munich in Germany by means of long term experiments. A dose of 300 krad has been found to be effective for the disinfection of anaerobically digested sludge at a unit cost which is of the same magnitude as the cost of thermal pasteurization. This paper examines: (1) the size and characteristics of the waste water association Ampergruppe near Munich, (2) the set up of the waste water treatment plant at Geiselbullach, (3) the experimental irradiation facility for disinfection of sludge at pilot plant level, (4) the radiation technology involved, (5) aspects of radiation protection, (6) costs of sludge disinfection by gamma radiation including side effects, (8) the research programs undertaken and planned. (NL)

17324 (EUR-ITAL-22) TECHNOLOGICAL EVALUATION OF A SEA-BORNE TRIAL SHIPMENT OF IRRADIATED ONIONS FROM THAILAND. Heins, H. G. (Association Euratom-ITAL, Wageningen (Netherlands)). Jan 1975. 10p. INIS.

A trial shipment of irradiated Thai onions was evaluated technologically. Half of the consignment carried on deck was rejected upon arrival because of rot. The second half, transported in a chilled room, showed no difference between irradiated and non-treated onions. However, after a sprout testing period of three weeks at ambient temperature, sprouting in non-irradiated onions

was almost complete while external sprouting of the irradiated onions hardly occurred. The overall result of this sea borne shipment was negatively influenced by the fact that irradiation was not applied at the optimal time after harvest. (NL)

17325 (EUR-ITAL-32) CONSULTING SERVICES IN THE AREA OF NUCLEAR TREATMENTS OF WASTE WATER IN SWITZERLAND. Groneman, A. F. (Association Euratom-ITAL, Wageningen (Netherlands)). Jun 1975. 5p. INIS.

There is a growing international interest by industry in the use of gamma irradiation for the disinfection of waste water sludges since these sludges are redistributed for use in agriculture after treatment. A Swiss waste water treatment plant was converted and an irradiation unit installed. The establishment of a coordinated research program between ITAL in the Netherlands, the plant in Switzerland and the plant manufacturer in Germany is reported. (NL)

17326 (SAND-75-0611) BENEFICIAL USES PROGRAM, Progress Report, Period Ending September 30, 1975. (Sandia Labs., Albuquerque, N. Mex. (USA)). Jan 1976. Contract AT(29-1)-789. 45p. Dep. NTIS $5.00.

Progress is reported on a program that involves a number of activities at Sandia Laboratories to develop the necessary technology for cost-beneficial use of a maximum amount of radioactive waste. Major activity is currently concentrated in the Waste Resources Utilization Program which has as its objective the use of cesium-134/137 as a gamma radiation source, coupled with modest heating, to treat sewage sludge to rid it of pathogenic organisms so that it may be safely used as a fertilizer or a feed supplement for ruminant animals. Other activities included in the Beneficial Uses Program are efforts to: (1) develop a cost-effective radioisotope separation technology based on column separation techniques associated with the Sandia Solidification Process and (2) develop a broader technology for beneficial applications of the separated isotopes. (auth)

17327 PROTEIN SYNTHESIS AND THE RECOVERY OF BOTH SURVIVAL AND CYTOPLASMIC PETITE MUTATION IN ULTRAVIOLET-TREATED YEAST CELLS. I. Nuclear-Directed Protein Synthesis. Heude, M.; Chanet, R.; Moustacchi, E. (Institut du Radium, Orsay, France). Mutat. Res.; 28: No. 1, 37-45(Apr 1975).

The contribution of nuclear-directed protein synthesis in the repair of lethal and mitochondrial genetic damage after uv irradiation of exponential and stationary phase haploid yeast cells was examined. This was carried out using cycloheximide, a specific inhibitor of nuclear protein synthesis. It appears that nuclear protein synthesis is required for the increase in survival seen after the liquid-holding of cells at both stages, as well as for the petite recovery seen after the liquid-holding of exponential phase cells. The characteristic negative liquid-holding effect observed for the uv induction of petites in stationary phase cells (increase of the frequency of petites during storage) remained, following all the treatments which inhibited nuclear protein synthesis. However, the application of photoreactivating light following dark-holding with cycloheximide indicates that some steps of the repair of both nuclear and mitochondrial damage are performed in the absence of protein synthesis. (NL)

17328 PROTEIN SYNTHESIS AND THE RECOVERY OF BOTH SURVIVAL AND CYTOPLASMIC PETITE MUTATION IN ULTRAVIOLET-TREATED YEAST CELLS. II. Mitochondrial Protein Synthesis. Heude, M.; Chanet, R. (Institut du Radium, Orsay, France). Mutat. Res.; 28: No. 1, 47-55(Apr 1975).

The contribution of mitochondrial proteins in the repair of uv-induced lethal and cytoplasmic genetic damages was studied in dark liquid-held exponential and stationary phase yeast cells. This was performed by using the specific inhibitors, erythromycin and chloramphenicol. It was shown that mitochondrial proteins are involved in the recovery and survival of uv-treated exponential phase cells, but not in the recovery of stationary phase cells. Mitochondrial proteins are partly implicated in the mechanisms leading to the restoration of the e^+ genotype in uv-irradiated dark liquid-held exponential phase cells. Here again, in stationary phase cells, mitochondrial enzymes do not seem to participate in the negative liquid-holding process for the e^- induction, as shown by inhibiting mitochondrial protein synthesis of both mitochondrial and nuclear protein synthesis. When cells are grown in glycerol, the response after dark liquid-holding of the uv-treated cells in the different growth stages is similar to that found for glucose-grown cells. In other words, the fate of cytoplasmic genetic damage in particular is not correlated with the repressed or derepressed state of the mitochondria. (NL)

17329 EFFECTS OF THE ESCHERICHIA COLI K12 recA56, uvrB, AND polA MUTATIONS ON uv REACTIVATION IN BACTERIOPHAGE T7. McKee, R. A.; Hart, M. G. R. (Queen's Univ., Belfast). Mutat. Res.; 28: No. 2, 305-308(May 1975).

17330 GAMMA-RAY INACTIVATION OF CONIDIA FROM HETEROKARYONS OF NEUROSPORA CRASSA CONTAINING uv-SENSITIVE MUTATIONS. Biological Interaction of Cell Nuclei. Shelby, M. D. (Oak Ridge National Lab., TN); Stine, G. J. Mutat. Res.; 28: No. 2, 147-154(May 1975).

Two-component heterokaryons were formed with the fungus Neurospora crassa. The uv-sensitive mutations upr-1, uvs-4, and uvs-6 were utilized. Conidia produced by these heterokaryons were exposed to gamma-rays and survival curves were established for the three conidial fractions produced by each heterokaryon. Results showed that upr-1, when included in only one nuclear component, did not affect the sensitivity of any conidial fraction; however, when included in both components, all three conidial fractions exhibited two to four-fold decreases in survival at the 30 krad exposure. The uvs-4 mutation, when included in one or both components, did not increase the sensitivity of any conidial fraction and appeared in contrast to impart a small increase in resistance to inactivation by gamma-rays. When included in only one component, uvs-6 increased the sensitivity of homokaryotic uvs-6 conidia but had no effect on the other two conidial fractions. When included in both components, uvs-6 resulted in exponential inactivation curves and at the 30 krad exposure, 100-fold decreases in survival for all three conidial fractions. (NL)

17331 MUTATIONS INDUCED BY X RADIATION IN THE YEAST SCHIZOSACCHAROMYCES POMBE. Loprieno, N.; Barale, R.; Baroncelli, S.; Cammellini, A.; Melani, M.; Nieri, R.; Nozzolini, M.; Rossi, A. M. (Univ., Pisa, Italy). Mutat. Res.; 28: No. 2, 163-173(May 1975).

Experiments on strains of yeast with different genetic backgrounds were done to evaluate the kinetics of inactivation and mutation induction by x-radiation. A system of forward mutation induction in five loci was used and a specific mutation rate was evaluated for the wild type. From a comparison of observations with wild type and radiation-sensitive strains, it may be assumed that in this yeast, mutations are mainly the result of a repair-active process. The range of genotypic and phenotypic influence upon the specific locus mutation rate was evaluated with appropriate biological material and experiments. (NL)

17332 POST-IRRADIATION MODIFICATION OF RADIATION-INDUCED HETEROALLELIC REVERSION IN DIPLOID YEASTS: EFFECT OF NUTRIENT BROTH. Rao, B. S.; Murthy, M. S. S.; Reddy, N. M. S.; Subrahmanyam, P.; Madhvanath, U. (Bhabha Atomic Research Centre, Bombay). Mutat. Res.; 28: No. 2, 183-189(May 1975).

The effect of post-irradiation growth in complete rich medium on the expression of the reversion to arginine-independence induced by gamma and alpha radiation in a heteroallelic diploid yeast strain (Saccharomyces cerevisiae BZ34) has been studied. During the post-irradiation treatment the reversion frequency increased, reached a peak at about 90 minutes and decreased thereafter reaching a constant value for treatment periods exceeding 6h. As determined by the increase in number of budding cells, extensive DNA synthesis took place in cells incubated only in the nutrient medium and not in the omission medium. Hence the observed increase in the reversion frequency is explained on the basis that post-irradiation DNA synthesis is necessary for the expression of gene conversion. The decrease in the reversion frequency for continued treatment with yeast extract, peptone, dextrose (YEPD) is related to the fact that only one daughter of the post-irradiation first cell division is a revertant. The broth effect was not lost when the irradiated cells were first incubated for 90 min in arginine-less medium and then transferred to the broth. Similarly, the broth effect even persisted at doses high enough to induce considerable division delay. These results suggest that the radiation-induced pre-conversional lesions are not susceptible to repair by alternative pathways. (NL)

17333 MECHANISMS OF RADIOSENSITIZATION WITH IODINE COMPOUNDS. Kada, T. (National Inst. of Genetics, Mishima, Japan). pp 569-573 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Evidence is provided to support the hypothesis that radiosensitization involves reactions between radiation-induced toxic products and cellular compounds containing SH-groups. (NL)

17334 HYPOXIC SENSITIZATION IN MAMMALIAN CELLS AND MODEL TUMORS. Whitmore, G. F.; Rauth, A. M.; Gulyas, S.; Bush, R. S. (Ontario Cancer Inst., Toronto). pp 574-580 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

There is evidence that radiation sensitizers that work in vitro might also give good results in vivo. Better understanding of the mechanisms of the action of ionizing radiation, the role of oxygen and other sensitizers in radiation damage and the pharmacological behavior of radiosensitizers is required. (NL)

17335 INDUCTION OF lambda-PROPHAGE BY IONIZING RADIATION. Lydersen, B. K.; Pollard, E. C. (Pennsylvania State Univ., University Park). Radiat. Res.; 64: No. 2, 237-244 (Nov 1975).

The dose-response relationship for the induction of lambda-prophage is a composite of the induction process and the capacity for phage development. Consequently, the character of the relation is hard to establish. Induction of lambda can be separated from capacity by studying the loss of immunity consequent on the derepression caused by ionizing radiation. The loss of immunity proves to be insensitive with a D_{37} of 100 krad and shows an oxygen enhancement ratio of two or greater. The capacity for prophage development has a 37 percent survival dose of 45 krad and exhibits an oxygen enhancement ratio of greater than 2. These findings suggest that there is a low yield of induction by ionizing radiation because the sensitivity of the capacity is greater than the probability of induction. (auth)

17336 INVOLVEMENT OF HYDROXYL RADICALS IN THE RELEASE BY IONIZING RADIATION OF A CELL SURFACE NUCLEASE FROM MICROCOCCUS RADIODURANS. Mitchel, R. E. J. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Radiat. Res.; 64: No. 2, 321-330(Nov 1975).

The ionizing radiation-induced release of a surface exonuclease from Micrococcus radiodurans is to a large extent inhibited by the removal of water. Irradiation of a cell suspension saturated with O_2 (an effective aqueous electron and hydrogen atom scavenger) allows the same release as irradiation in the presence of N_2. Ethanol (a good hydroxyl radical scavenger) protects the enzyme from release. These data suggest that hydroxyl radicals produced by the radiolysis of water are important releasing agents. Hydroxyl radicals produced by the ultraviolet decomposition of H_2O_2 were effective in releasing the enzyme. (auth)

17337 REPAIRABLE SUBLETHAL DAMAGE INDUCED BY ^{210}Po ALPHA RAYS AND ^{60}Co GAMMA RAYS IN DIPLOID YEAST. Murthy, M. S. S.; Reddy, N. M. S.; Rao, B. S.; Subrahmanyam, P.; Madhvanath, U. (Bhabha Atomic Research Center, Bombay). Radiat. Res.; 64: No. 2, 376-379(Nov 1975).

Recombination frequencies induced by gamma and alpha radiations in diploid yeast at various survival levels have been analyzed. This analysis shows that the damage caused by low LET radiation can be repaired about three times more efficiently than that caused by high LET radiation. This corroborates the information obtainable from a study of the survival curves for these two types of radiations. (auth)

17338 ORIGIN OF CELL SURFACE PROTEINS RELEASED FROM MICROCOCCUS RADIODURANS BY IONIZING RADIATION. Mitchel, R. E. J. (Atomic Energy of Canada Ltd., Chalk River, Ont.). Radiat. Res.; 64: No. 2, 380-387(Nov 1975).

The exposure of Micrococcus radiodurans to sublethal doses of ionizing radiation causes the release of certain proteins into the surrounding medium. As estimated by sodium dodecyl sulfate-polyacrylamide gel electrophoresis, these proteins range from approximately 20,000 to 125,000 daltons. At least some of the proteins, including an exonuclease, have a surface location and appear to originate from the lipid-rich midwall layer. The exonuclease has two functionally distinct locations, one with its active site available to external substrate and a second with the active site masked from the exterior. Ionizing radiation releases both the masked and unmasked activity into the surrounding medium. (auth)

17339 RECOVERY OF THE ACCUMULATION ABILITY OF THIOMETHYL-beta-GALACTOSIDE IN ESCHERICHIA COLI AFTER BACTERIOPHAGE T4 INFECTION. Saijo, N.; Okamoto, K. (Osaka Univ.). J. Virol.; 17: No. 2, 299-306(Feb 1976).

Effects of uv-irradiated and unirradiated T4 phage infection on the beta-galactoside accumulation ability in Escherichia coli have been examined by the use of ^{14}C-labeled thiomethyl-beta-galactoside (TMG). Under conditions where a synchronous adsorption of phage takes place, the cellular ability for TMG accumulation is found to be largely inhibited immediately after phage adsorption but it recovers with time to a new level, which is dependent on the multiplicity of infection. When cells are infected with uv-irradiated T4 at the same multiplicity as that of unirradiated phage, the cellular accumulation ability is more severely inhibited and there is no recovery from the inhibition. The recovery process in T4-infected cells is mostly sensitive to puromycin. These results suggest that the initial inhibition of the TMG accumulation ability is probably caused by the adsorption of phage coats, and the subsequent restoration occurs through the action of a phage-directed protein(s). In the recovery process, no new transport system appears to be involved. The restored ability of TMG accumulation is resistant to the action of superinfecting uv phage. However, different mechanisms appear to be operating in T4-infected cells for the establishment of resistance to ghosts and for the recovery from the phage coat-induced inhibition. (auth)

17340 GENETIC CONTROL OF MULTIPLE PATHWAYS OF POST-REPLICATIONAL REPAIR IN uvrB STRAINS OF ESCHERICHIA COLI K-12. Youngs, D. A.; Smith, K. C. (Stanford Univ., CA). J. Bacteriol.; 125: No. 1, 102-110(Jan 1976).

The effect of the recA, uvrD, exrA, and recB mutations and of post-irradiation treatment with chloramphenicol on the survival and post-replicational repair after ultraviolet irradiation of uvrB strains of Escherichia coli K-12 was examined. Each of these mutations or treatments was found to decrease survival and the extent of repair. The interactions of the inhibitory effects of the uvrD, exrA, and recB mutations and chloramphenicol treatment were determined by examining the survival and repair characteristics of the several multiple mutants. The survival results suggest that the post-replication repair process in uvrB strains may be subdivided into at least five different branches. These include three branches that are blocked by the exrA, recB, or uvrD mutation, a fourth branch that is blocked by any one of these mutations and is also sensitive to chloramphenicol treatment, and at least one additional branch that is not sensitive to either of these mutations or to chloramphenicol treatment. The extent of post-replicational repair observed with each of the strains is in general agreement with the pathways postulated on the basis of the survival data, although there are several apparent exceptions to this correlation. (auth)

17341 INACTIVATION OF ADENOSINE 5'-TRIPHOSPHATE SYNTHESIS AND REDUCED-FORM NICOTINAMIDE ADENINE DINUCLEOTIDE DEHYDROGENASE ACTIVITY IN ESCHERICHIA COLI BY NEAR-ULTRAVIOLET AND VIOLET RADIATIONS. Lakchaura, B. D.; Fossum, T.; Jagger, J. (Univ. of Texas, Dallas). J. Bacteriol.; 125: No. 1, 111-118(Jan 1976).

Near-ultraviolet (near-uv) light (300 to 380 nm) is a significant component of sunlight and has a variety of effects on biological systems. The present work is an attempt to identify chromophores (molecular absorbers of light) and targets (critical damaged molecules) for inhibition of adenosine triphosphate (ATP) synthesis in Escherichia coli by near uv. The fluence at 334 nm required for 37 percent survival of net ATP synthesis (F_{37}) in E. coli AB2463 in succinate medium is 140 kJ/m^2. The action spectrum for this inactivation is almost structureless, exhibiting a smooth transition from high efficiency at 313 nm to low efficiency at 405 nm. The action spectrum for inhibition of net ATP synthesis is consistent with the chromophore being either ubiquinone Q-8 or vitamin K_2. The fluence required is consistent with ubiquinone Q-8 also being a target molecule. The activity of reduced nicotinamide adenine dinucleotide dehydrogenase in extracts of E. coli B is also inactivated near uv and shows an F_{37} of about 40 kJ/m^2. The action spectrum for this effect is quite structureless; it shows high efficiency at 313 nm and low efficiency at 435 nm. The data do not suggest a target molecule for this action, although it is possible that ubiquinone Q-8 absorbs the near-uv energy and then passes it on to some other target molecule. The data further indicate that inactivation of the oxidative phosphorylation system is not a primary factor in near-uv-induced growth delay in E. coli. (auth)

17342 PHYSICAL SIZE OF THE DONOR LOCUS AND TRANSMISSION OF HAEMOPHILUS INFLUENZAE AMPICILLIN RESISTANCE GENES BY DEOXYRIBONUCLEIC ACID-MEDIATED TRANSFORMATION. Bendler, J. W. III. (Medical Coll. of Wisconsin, Milwaukee). J. Bacteriol.; 125: No. 1, 197-204(Jan 1976).

The properties of donor deoxyribonucleic acid (DNA) from three clinical isolates and its ability to mediate the transformation of competent Rd strains to ampicillin resistance were examined. A quantitative technique for determining the resistance of individual Haemophilus influenzae cells to ampicillin was developed. When this technique was used, sensitive cells failed to tolerate levels of ampicillin greater than 0.1 to 0.2 mu g/ml, whereas three resistant type b beta-lactamase-producing strains could form colonies 1- to 3-mu g/ml levels of the antibiotic. DNA extracted from the resistant strains elicited transformation of the auxotrophic genes in a multiply auxotrophic Rd strain. For two of the donors, transformation to ampicillin resistance occurred after the uptake of a single DNA molecule approximately 10^4-fold less

frequently than transformation of auxotrophic loci and was not observed to occur at all with the third. The frequency of transformation to ampicillin resistance was two- to fivefold higher in strain BC200 (Okinaka and Barnhart, 1974), which was cured of a defective prophage. All three clinical ampicillin-resistant strains were poor recipients, but the presence of the ampicillin resistant genes in strain BC200 did not reduce its competence. (auth)

17343 EXCISION OF PYRIMIDINE DIMERS IN TOLUENE-TREATED ESCHERICHIA COLI. Deutsch, W. A.; Dorson, J. W.; Moses, R. E. (Baylor Coll. of Medicine, Houston, TX). J. Bacteriol.; 125: No. 1, 220-224(Jan 1976).

Toluene-treated cells were used for examining excision of pyrimidine dimers in Escherichia coli strains W3110, DM845 ($uvrA^-$), P3478 ($polA^-$), and KS5064 (polA/sub ex 1/). Excision occurring in toluene-treated cells in rapid, adenosine 5'-triphosphate dependent, and requires the uvrA gene function. In strains lacking either the polymerizing or 5' yields 3' exonucleolytic activity of deoxyribonucleic acid polymerase I, excision does occur. However, both in vivo and in vitro, the excision in such strains is initially slower than wild type. (auth)

17344 CONTRIBUTION TO THE TOXICOLOGY OF PEROXIDE BONDS. Wolf, A.; Hrivnak, D.; Svabova, M.; Vacek, K. Cesk. Hyg.; 19: No. 2, 79-84(1974). (In Czech).

Toxicity of peroxide bonds in relation to the residual effects of irradiated food proteins was studied. It was found that free peroxide radicals are bound proteins. The bonds are not rigid and return to the norm after some time. Casein was irradiated with a dose of 1 Mrad at an intensity of $2.5 \times 10^6 \times g^{-1}$ min^{-1} and the biological value was tested on Tetrahymena piriformis and Streptococcus zymogenes NDCO 592. Electronic paramagnetic resonance was used to detect the free peroxide radicals. Casein incubated with hydrogen peroxide for 2 and 24 hrs respectively in a concentration of 1 M and 0.1 M eliminating surplus peroxide by catalase, served as a model. The toxic effect was tested in a feeding experiment on albino mice. The microbiological test showed a 40% growth in the samples within 24 hrs after irradiation. This effect decreased with time and after 35 days there was no difference in comparison with controls. The control experiment with incubated peroxide revealed besides a marked inhibition also its constant character. The feeding experiment proved the toxic effect of oxidized protein not only in the mortality rate of 16.2% of experimental animals but also in the negative trend of the growth curve, behavioral changes and inhibited movement. Post mortem examination revealed a 10% increase in kidney weight in comparison with controls. (auth)

17345 LETHAL AND MUTAGENIC EFFECTS OF GAMMA RAYS ON CHAETOMIUM AUREUM CHIVERS. Curr. Sci. (India); 44: No. 23, 855-857(5 Dec 1975).

Ascospore suspensions of Chaetomium aureum were irradiated with ^{60}Co gamma rays at doses of 20, 30, 40, 50, 60, and 70 kR, plated on P-complete medium, and analyzed for lethal and mutagenic effects. A sharp decline with increasing dose was noted for survival of the ascospores. The frequency of biochemical and morphological mutations peaked at 60 kR doses. Loss of cellulolytic activity was observed with all of the morphological mutations while a decrease was noted as well with the biochemical mutations. (ERB)

17346 COMBINED HEAT-IRRADIATION EFFECT ON DEOXYRIBONUCLEIC ACID OF PENICILLIUM EXPANSUM LK. EX. THOM. Roy, M. K.; Mehta, S. L. (Indian Agricultural Research Inst., New Delhi). Int. J. Radiat. Biol.; 28: No. 3, 291-296(Sep 1975).

An investigation has been carried into the combined effects of hot water (50°C) and gamma irradiation (150 krad) on double-stranded DNA isolated from apple mould fungus, Penicillium expansum. Spectrophotometric thermal denaturation studies showed that the combined treatments reduced the temperature (Tm) corresponding to half the increase in relative absorbance from 88.0°C to 86.0°C, and the mole per cent guanine and cytosine (G + C) bases from 45.6 to 40.7. The hyperchromicity of the treated fungal DNA (8.7%) was 50% of that of the DNA from the control fungus (17.4%). The buoyant densities of the DNA samples and their (G + C) contents were determined by CsCl density-gradient centrifugation. The destruction of G + C bases of DNA on treatment with heat and radiation indicated by the thermal denaturation studies was confirmed by the decrease in buoyant density from 1.708 g/cm^3 to 1.697 g/cm^3 reflecting similar per cent (G + C) base decreases of treated (37.7%) as compared with control (48.9%) fungal DNA. The hypochromic effect observed with the treated DNA probably reflected hydrogen-bond breakage in addition to base damage. (UK)

17347 COMPONENTS IN THE RADIATION SENSITIZATION OF BACTERIAL SPORES BY P-NITROACETOPHENONE. The .OH Component. Ewing, D. (Univ. of Texas, Austin). Int. J. Radiat. Biol.; 28: No. 2, 165-176(Aug 1975).

p-Nitroacetophenone (PNAP) sensitizes Bacillus megaterium spores under anoxic conditions to the lethal effects of 50 kVp x rays. Concentrations between $\sim 5 \times 10^{-4}$ M and 3.8×10^{-3} M produce the maximum effect, an increase of about 30 per cent over the anoxic response when the spores are irradiated in water. Compounds that scavenge .OH decrease, but cannot completely eliminate, this maximum amount of sensitization. These results indicate that PNAP acts to increase spores' radiation sensitivity through two separable types of chemical reactions: one which involves .OH and one which does not. Possible mechanisms responsible for these two components of damage are discussed. In these experiments $^1/_{15}$ M phosphate buffer acts in several unexpected ways. This concentration itself increased the anoxic spore response by about 9 per cent (relative to the anoxic response in water). In addition, although the maximum amounts of sensitization were the same, the amounts of sensitization from lower PNAP concentrations differed when the suspending fluid was buffer instead of water. An interaction was also seen during the PNAP-t-butanol experiments; again, the responses at low PNAP concentrations were different in buffer and in water. No mechanisms for these actions of this buffer were suggested, although somewhat similar effects may occur with other organisms. Clearly, such effects must be recognized and evaluated before quantitative analyses of the actions of sensitivity-modifying agents can be completed. (auth)

17348 MODIFICATION OF THE RESPONSE TO 8 MeV ELECTRONS OF AUXOTROPHIC STRAINS OF ESCHERICHIA COLI BY AMINO-ACID DEPRIVATION AND RIFAMPICIN. Bryant, P. E.; Shaw, M. B. (Hammersmith Hospital, London). Int. J. Radiat. Biol.; 28: No. 2, 147-154(Aug 1975).

An investigation has been made of the possibility that the accumulation of RNA enriched in messenger can influence the survival of bacteria after exposure to 8 MeV electrons. The multiple amino-acid auxotroph E. coli CP79 RC^{rel} accumulates RNA during inhibition of protein synthesis, and the proportion of RNA present as messenger increases by a factor of 3 during a 2-hour period of amino-acid deprivation. Amino-acid withdrawal led to changes in the shape of the survival curve, which also occurred in strain CP78 Rc^{err}, which synthesizes very little RNA when deprived of amino acids. It is concluded that accumulation of RNA enriched in messenger plays little or no part in modification of the survival of irradiated bacteria. It is shown that rifampicin, an inhibitor of RNA synthesis, increases the sensitivity of both strains equally. (auth)

17349 RADIOSENSITIZATION OF T_7 BACTERIOPHAGE BY 8-METHOXYPSORALEN. Becker, D.; Grossweiner, L. I.; Ovadia, J.; Redpath, J. L. (Michael Reese Hospital, Chicago). Int. J. Radiat. Biol.; 28: No. 2, 195-198(Aug 1975).

The radiosensitization of T_7 bacteriophage by 8-methoxypsoralen was investigated. It was found that 8-MOP sensitizes the inactivation for T_7 phage in nitrogen-saturated nutrient medium but has no effect in oxygenated solutions. It is proposed that the principal lesions in T_7 phage are single-strand breaks produced in high yield with low lethality, double strand breaks produced in low yield with high lethality and cross-links accounting for about 50% of inactivation in the absence of oxygen or exogeneous sulphydryl. The anoxic action of 8-MOP is attributed to the promotion of cross link type lesions. (UK)

17350 RADIATION-RESISTANT RED BACTERIUM FROM RICE. Engvild, K. C.; Berenstein, D. (Danish Atomic Energy Commission, Risoe). Int. J. Radiat. Biol.; 28: No. 2, 191-193 (Aug 1975).

Strains of a carrot-red, radiation-resistant bacterium, Pseudomonas radiora, were isolated during work on the radiation conservation of rice. The present work was done to see if similar organisms could be found on rice bought in Denmark. Red bacteria were isolated from 9 to 15 samples of rice, either directly or after gamma- or uv-irradiation. As dried droplets on polyethylene foil, they were inactivated to 10^{-6} survivors after gamma doses between 1.0 and 3.5 Mrad. Danish isolates were similar to a Japanese strain, but the bacteria should perhaps not be classified as Pseudomonas. (auth)

Radiation Effects on Plants

17351 (LBB-24) MUTATION BREEDING OF BULB CROPS BY MEANS OF RADIOACTIVE IRRADIATION AND OTHER METHODS. Alkema, H. Y. (Laboratorium voor Bloembollenonderzoek, Lisse (Netherlands)). Jan 1974. 19p. (In Dutch). INIS.

Results of mutation breeding of bulb crops by means of radioactive irradiation, colchicine, and heat treatment are discussed.

The optimal dose of x radiation is stated. Mutation frequency was low; it is suggested to apply radiation on plant material that is propagated by way of adventitious buds. (NL)

17352 PHOTOREACTIVATION OF NITRATE REDUCTASE PRODUCTION IN NICOTIANA TABACUM VAR. XANTHI. Wright, L. A. Jr.; Murphy, T. M. (Univ. of California, Davis). Biochim. Biophys. Acta; 407: No. 3, 338-346(15 Oct 1975).

Ultraviolet (254 nm) irradiation of liquid-cultured tobacco cells inhibited the production of nitrate reductase; subsequent illumination with white light allowed a partial restoration of the synthesis of the enzyme (photoreactivation). Ultraviolet irradiation of these same cells also inhibited their ability to incorporate labeled uridine and labeled amino acids. Subsequent illumination with which light gave a partial restoration of the ability of the cells to incorporate uridine while a similar post-ultraviolet-irradiation treatment failed to restore the amino acid incorporation. The system in tobacco known to repair ultraviolet-damaged viral RNA thus does not seem to repair ultraviolet damage to the protein-synthesizing system of the cell. The photoreactivation of nitrate reductase production is best explained by the action of a DNA photorepairing system. (NL)

17353 BIOLOGICAL EFFECTS OF NEGATIVE PIONS. Raju, M. R. (Los Alamos Scientific Lab., NM). Excerpta Med. Int. Congr. Ser.; 2: 441-446(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Programs are suggested to evaluate the physical and radiobiological properties of pion-minus beams before their therapeutic application. Besides establishing isodose contours and machine output information, depth dose profiles also have to be studied. RBE and OER vary as a function of depth. Mammalian cell cultures can be used to study these phenomena. In vitro measured RBE values can be checked and late radiation effects can be studied in experiments with animals. Also the therapeutic effect upon transplantable neoplasms in animals can be investigated. (NL)

17354 RESPONSE TO X RAYS OF DORMANT AND NON-DORMANT SEEDS OF TRITICUM DURUM DESF. Floris, C.; Meletti, P.; Anguillesi, M. C. (Univ., Pisa, Italy). Mutat. Res.; 28: No. 1, 63-67(Apr 1975).

The x-ray sensitivity of dry seeds of durum wheat at different levels of dormancy was examined. Two doses of x-ray exposures (1000 and 5000 R) were utilized and an analysis was carried out on cells from the root tip meristems of seeds which were allowed to germinate on moistened filter paper at different times. The results showed that the 1000 R dose did not increase the spontaneous chromosome damage in deep dormant seeds, but it did induce a 100 percent increase in chromosome damage in lightly dormant and non-dormant seeds. The deep dormant seeds irradiated with 5000 R showed a chromosome damage lower than that of both lightly dormant and non-dormant seeds. The chromosome damage was of chromatid type at 1000 R, irrespective of the physiological condition of the seeds. On the contrary, the lightly dormant or non-dormant seeds irradiated with the 5000 R showed both chromatid and chromosome damage; the deep dormant seeds exhibited chromatid damage only. The lack of chromosome damage in root meristems from deep dormant seeds is likely to be due to (1) the physiological state of seeds which causes a slow germination and a possible delay of mitosis initiation at germination, (2) a more efficient repair process or a greater radiation resistance bound to the metabolic condition of the deep dormant seeds. (NL)

17355 REPAIR OF BREAKS INDUCED BY X-RAYS IN THE DNA OF THE BLUE-GREEN ALGA: ANACYSTIS NIDULANS. Shestakov, S. V.; Elanskaya, I. V.; Glazer, V. M.; Zhevner, V. D. (Moscow State Univ.). Dokl. Biol. Sci.; 222: No. 1-6, 218-220 (1975).

Translated from Dokl. Akad. Nauk SSSR; 222: No. 5, 1217-1219(Jun 1975).

Procedures are described for culturing and irradiating the algae and preparation of the lysate. In the DNA from cells lysed immediately after irradiation in tris-HCl buffer at 20° substantially fewer breaks were detected than in samples under other conditions of irradiation. Irradiation at low temperature or in CS buffer created hindrances to processes of repair. (HLW)

17356 DOES REPAIR OR STAGE SENSITIVITY DETERMINE THE SHAPE OF TIME-EFFECT CURVES IN RADIATION MUTAGENESIS. Luchnik, N. V.; Morozov, K. N.; Fesenko, E. V. (Scientific Research Inst. of Medical Radiology, Obninsk, USSR). Mutat. Res.; 28: No. 2, 199-210(May 1975).

Seedlings of Crepis capillaris were irradiated after pulse labelling with tritiated thymidine, and both chromosomal aberrations and the presence of silver grains were recorded in the same metaphase cells at various intervals throughout the whole mitotic cycle. The following results were obtained: (a) irradiated roots were homogeneous with respect to the number of aberrations, and heterogeneous with respect to the labelling index; (b) time-effect curves for labelled and unlabelled cells showed no significant difference from one another; (c) no significant quantitative difference in aberration spectra produced in S and G2 stages were found. These results support the view that the major factor which determines both quantitative and qualitative variation in the production of chromosomal aberrations by radiation is the time lapse between irradiation and fixation rather than the relation of the time of irradiation to the time of DNA synthesis. In addition, it was found that labelling with tritiated thymidine modifies the effect of radiation in chromosomes. (NL)

17357 5th ANNUAL MEETING OF THE EUROPEAN SOCIETY OF NUCLEAR METHODS IN AGRICULTURE HELD SEPTEMBER 19, 1974, IN BUCHAREST, ROMANIA. Wageningen, Netherlands; European Society of Nuclear Methods in Agriculture (1974). 80p.

These 1974 Proceedings of the European Society of Nuclear Methods in Agriculture contain reports in the form of minutes of the meetings of various working groups of the Society, the program and official addresses of the fifth annual meeting including annual reports of the chairman and the secretary of the Society, and the reports of each of the eleven working groups as well as the four following surveys entitled: (1) some aspects of research in plant breeding, conservation of genetic resources in connection with irradiation processes (by A. Jacques from FAO), (2) our responsibility for the environment (by D. Zeeuw from ITAL), (3) pilot plant for the irradiation of sewage sludge (by A. Suesz from Bayerische Landesanstalt fuer Bodenkultur und Pflanzenbau, Munich), (4) nuclear agronomy in France (by P. Guerin de Montgareuil from CEN, Cadarache). Summaries and provisional papers on presented topics will be published in "ESNA Newsletter." (NL)

17358 DOSE RATE, MITOTIC CYCLE DURATION, AND SENSITIVITY OF CELL TRANSITIONS FROM G1 yields S AND G2 yields M TO PROTRACTED GAMMA RADIATION IN ROOT MERISTEMS. Evans, L. S.; Hof, J. V. (Brookhaven National Lab., Upton, NY). Radiat. Res.; 64: No. 2, 331-343(Nov 1975).

Experiments were designed to determine the relative radiosensitivity of the cell transition points of G1 yields S and G2 yields M in root meristems of several plant species. Label and mitotic indices and microspectrophotometry were used to measure the proportions of cells in each mitotic cycle stage in root meristems after protracted gamma radiation. The criterion of radiosensitivity was the dose rate needed to produce a tissue with less than 1 percent cells in S and none in M after 3 days of continuous exposure. The results show that DNA is the primary radiation target in proliferative root meristems and that the cycle duration stipulates the time interval of vulnerability. In each species, nonrandom reproducible cell proportions were established with 2C:4C:8C amounts of nuclear DNA after 3 days of exposure. Roots of Helianthus annuus, Crepis capillaris, and Tradescantia clone 02 had 80 percent cells with a 2C amount of DNA and 20 percent had a 4C amount of DNA. In these species the transition point of G1 yields S was more radiosensitive than G2 yields M. Roots of Pisum sativum and Triticum aestivum had cell proportions at 2C: 4C:8C amounts of DNA in frequencies of 0.10 to 0.20:0.40 to 0.60:0.30 to 0.40. In these two species 0.30 to 0.40 cells underwent radiation-induced endoreduplication that resulted from a rapid inhibition of cell transit from G2 yields M and a slower impairment of G1 yields S. Cells increased from 2C to 4C and from 4C to 8C amounts of DNA during irradiation. The proportions of nuclei with 2C:4C:8C amounts of DNA were dependent in part upon the relative radiosensitivity of the G1 yields S and G2 yields M control points. The data show the relative radiosensitivity of the transition points from G1 yields S and from G2 yields M was species specific and unrelated to the cycle duration and mean nuclear DNA content of the plant species. (auth)

17359 PROCESS OF THE THERMAL DESTRUCTION OF COTTON FIBER GROWN FROM SEEDS EXPOSED TO γ RADIATION. Muinov, T. M.; Marupov, R.; Kapkaeva, S. Kh. (Physical-Technical Inst., Dushanbe, USSR). Dokl. Akad. Nauk Tadzh. SSR; 18: No. 2, 26-30(1975). (In Russian).

It was shown that the thermal destruction of cotton (variety 108-F) grown from non-irradiated and irradiated seeds proceeds in two steps with activation energies of $E_1 = 30 \pm 2$ kcal/mol and $E_2 = 41 \pm 2$ kcal/mol. The low value of the activation energy E_1 in the first stage of pyrolysis is explained by the destruction of the defective spots in the macromolecules of cotton. It was established that preliminary irradiation of the seeds affects the relative number of defective spots in the macromolecules and it reaches a maximum of 8 kR. Additional increase of the dose up

to 56 kR leads to a decrease of the number of defective spots which indicates the very high ordering of the structure of the cotton fibers investigated. (tr-auth)

17360 EFFECT OF X-RAYS ON DEVELOPING EMBRYOS OF RICE (O. SATIVA L.) AND THEIR MUTATION SPECTRUM. Chakraborty, A. (Univ. of Burdwan, India). Curr. Sci. (India); 44: No. 21, 781-782(5 Nov 1975).

Proembryos of a high yielding rise variety (IR-8) were subjected to x rays at doses of 2.5, 5.0, and 7.5 kR at 5, 8, 12, and 24 hrs after pollination and subsequently examined for sterility and mutation frequency, % germination, and seedling lethality. Sterility and lethality increased with increasing dose at all stages. It was found, however, that comparatively lower doses of x rays can be effectively used for induction of mutation if treated at the proembryonic stage. (ERB)

17361 EFFECTS OF SEED TREATMENT WITH ^{60}Co GAMMA RAYS AND MICRONUTRIENTS ON GERMINATION AND GROWTH OF CORN SEEDLINGS. Bakr Ahmed, M.; El-Basyouni, S. Z. M.; Ashour, N. I.; Sayed, A. M. (Cairo Univ.). Curr. Sci. (India); 44: No. 21, 761-766(5 Nov 1975).

Gamma irradiation and soaking in solutions of some micronutrient elements, as presowing treatments of corn seeds, towards improving the germination of seeds, and increasing the growth of seedlings were investigated. The seeds were exposed to 12 irradiation doses of gamma rays ranging from 250 to 8000 R. It was found that stimulatory effects on the germination percentage and capacity of seeds as well as the height and the dry weight of seedlings were exerted only by the low irradiation doses from 500 to 1000 R. Soaking cornseeds, before sowing, in any of the four concentrations ranging from 250 to 1000 ppm of molybdenum, manganese, and zinc indicated that molybdenum treatment increased plant height and the dry weight of seedlings; 500 ppm molybdenum gave the best effect. Irradiation of 500 ppm molybdenum soaked seeds with low doses of gamma rays stimulated the germination process and early growth of seedlings, with the 500 R dose being most effective. (auth)

17362 OER AND RBE FOR 10 MeV ELECTRONS, AND THE TWO-COMPONENT THEORY OF RADIATION ACTION. Winston, B. M. (Christie Hospital and Holt Radium Inst., Manchester, Eng.); Oliver, R.; Berry, R. J. Int. J. Radiat. Biol.; 28: No. 2, 187-190(Aug 1975).

The root-growth in Vicia, after irradiation under oxygenated and anoxic conditions, was compared for single exposure to 250 kVp x rays and to the 10 MeV electron beam from a linear accelerator. O.e.r. and r.b.e. values for high-energy electrons thus determined would be compared with the predictions of Wideröe. It was found that the expected increase in o.e.r. for electron irradiation predicted by Wideröe's model should have been observed if it had occurred. In addition, the significantly decreased r.b.e. for electron irradiation which was predicted by the model is clearly not observed. (UK)

17363 EFFECTS OF IONIZING RADIATIONS ON ROSES. II. Meiotic Studies on Rose Cultivar "Pink Parfait" and Its Gamma Ray Induced Mutants. Lata, P. (Radiation Biology Lab., Lucknow, India). Cytologia (Tokyo); 40: 633-638(1975).

A comparative study of the male meiosis in the rose cultivar "Pink Parfait" and its two, Deep and Light pink flowered, mutants was conducted. "Pink Parfait" was found to be a segmental allotetraploid. The frequency of univalents and quadrivalents at metaphase I was higher in the mutants. Anaphase I revealed a higher incidence of lagging chromosomes in Deep pink mutant and an increased frequency of chromosome bridges in both the mutants. The deleterious effects of radiations were evident from the higher percentage of chromosomal aberrations and pollen sterility found in mutants as compared with the control. (auth)

Radiation Effects on Animals

Man

Refer also to abstracts 17233, 17234, 17474, and 17904.

17364 (AD/A-008267) MEANS OF INDIVIDUAL PROTECTION AND CONTROL OF THE ACTION OF IONIZING RADIATION. Reformatskii, I. A. 28 Jun 1974. Translation of Mono. Goryachie i Izotopnye Laboratorii, Moscow, 1971, p227-240. (FSTC-HT-23-0524-74). 20p. NTIS $3.25.

The report describes methods for using individual protection means, and monitoring the effects of ionizing radiation in hot laboratories. Dangerous radioactive substances can affect the skin surface or can be absorbed into the body. Special protective clothing, gloves, suits, footwear, has been designed to combat the first and special masks help to prevent the second. Monitoring equipment, both portable and fixed, can be used to test the atmosphere and provide safety for personnel working in conditions where radiation could occur. (GRA)

17365 (AED-CONF-74-725-000(Vol.1), pp 7-19) THE AIMS OF THE FEDERAL GOVERNMENT IN THE FIELDS OF RADIATION PROTECTION AND ENVIRONMENTAL PROTECTION. Sahl, W. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany); Vereinigung Deutscher Strahlenschutzaerzte e.V., Muenchen (F. R. Germany)).

Following a short survey on the development of radiation protection and environmental protection in the Federal Republic of Germany, the problems posed by the increasing use of nuclear energy for energy supply are outlined. The measures provided by the 4th Atomic Energy Program in the field of radiation protection are mainly concerned with the reduction of the emission of fission products from nuclear reactors, with the development of suitable concepts for accidents, and with a comprehensive control of emission and immission. Also envisaged are general investigations for the assessment of radiation risks. Subsequent to this survey, the basic theses of the environmental program are cited, the aims for the realization of a high standard of safety are presented, and points of main effort for the nearest future are given. (DE)

17366 (AED-CONF-74-725-000(Vol.1), pp 20-34) AIMS AND BASIC CONCEPTS OF ENVIRONMENTAL PROTECTION IN SWITZERLAND. Boehlen, B. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

On the basis of the steps taken so far for the protection of man and his natural environment in Switzerland, the bill on environmental problems proposed by a commission of experts of the Swiss office for environmental protection is discussed. The bill allows a pragmatic proceeding in various sections and thus provides time for the drawing-up of medium- and long-term environmental protection programs on a large scale. (DE)

17367 (AED-CONF-74-725-000(Vol.1), pp 35-59) THE SOMATIC RISK POSED BY RADIOLOGIC AND CHEMICAL ENVIRONMENTAL INFLUENCES. Jacobi, W. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

The paper tries to illustrate the analogies as well as the differences between ionizing radiation and chemotoxic agents with regard to their adverse somatic effects and the concepts for the determination of limiting values for dose or concentration. On the basis of experience on the cancerogenic and genetic effects of ionizing radiation, the limiting radiation doses for the population were set so low that acute harmful effects of radiation are ruled out. The legal concentration limiting values for many nonmutagenic chemical pollutants, on the other hand, are often based on nothing but a comparison with their acute effects, with the assumption that there is a threshold concentration. This concept is discussed by the example of different pollutants and compared with the natural and man-made level of these pollutants. The findings show that acute effects of chemical pollutants leading to increased morbidity and even mortality of the general population under adverse conditions cannot be ruled out. The assessment of the delayed effects of ionizing radiation and chemical pollutants poses the same problems. Epidemiological statistics suggest that artificial and also natural cancerogenics have a significant influence on the cancer incidence. Animal experiments show that for ionizing radiation as well as for chemical cancerogenics, the mean latency period for cancer lengthens with decreasing dose. (DE)

17368 (AED-CONF-74-725-000(Vol.1), pp 60-74) GENETIC RISKS POSED BY RADIOLOGICAL AND CHEMICAL ENVIRONMENTAL EFFECTS – LIMITING VALUES. Ehling, U. H. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

In order to determine the genetic risk of a technological environment, its radiogenetic, chemogenetic, and tolerable risks are described and discussed. Of decisive importance for the assessment of the genetic risk is the question of whether the mutation rate approaches the incidence of hereditary diseases leading to what Newcombe has called "Human Ill Health". A revision of the radiation protection regulations would only be justified if a general concept of the genetic risk would be drawn up, as the concentration on radiation leads to a false estimation of the tolerable risk. Standards for the controlled use of chemical mutagenics and their consideration in the radiation protection regulations are therefore imperative. (DE)

17369 (AED-CONF-74-725-000(Vol.1), pp 75-85) NUMERICAL MEASURE FOR THE RISK IN HANDLING RADIOACTIVE SUBSTANCES. Hunzinger, W. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

The paper explores criteria for the determination of the danger of radioactive materials, selecting those that enable a quantitative assessment of the risk in handling various radionuclides in certain chemical or physical states to be made. This determination can be made using the accumulated dose equivalent in the critical organ after a single inhalation of the radioactive material in the water-soluble state. A different model procedure is proposed for gases. The resulting classification of common radioactive substances in their order of toxicity as stated by the revised Swiss radiation protection ordinance is presented. (DE)

17370 (AED-CONF-74-725-000(Vol.1), pp 86-101) LEGAL FUNDAMENTALS OF RADIATION PROTECTION AND ENVIRONMENTAL PROTECTION. Vollmer, L. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

Effective radiation protection is becoming increasingly important for purposes of environmental protection. A lot of special laws have already been passed in order to carry out the mandate concerning environmental protection. The same goes for radiation protection. Looking at the whole complex critically one has to start from the fact that environmental and radiation protection legislation has to be treated similarly. An attempt is made to put into law the requirements which are made on power plants and equipment as well as on the persons dealing with these and radioactive materials. To define these requirements adequately which would offer optimum radiation protection presents the problem. (DE)

17371 (AED-CONF-74-725-000(Vol.1), pp 180-190) ASSESSMENT OF THE RADIATION RISK AFTER AN EMISSION LASTING SEVERAL HOURS IN NORTHERN GERMANY. Voelz, E. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

The radiation risks near the site of nuclear power stations can be estimated for two cases. In normal operation, only small quantities of radioactive material are discharged whose concentrations can be given in a statistical diffusion model if the frequency distribution of source quantities and meteorological parameters is known. On the other hand, the concentrations for short-time emissions can be estimated in a stationary model if the source quantity and the meteorological conditions remain constant for longer than about an hour. As activity will probably be emitted over several hours under varying weather conditions in the case of an unforeseen accident, attempts have been made to estimate the possible concentrations and the resulting radiation loads for these periods of emission. Single fields of concentration have therefore been calculated from hour to hour and have been added up to the emission times under consideration. The resulting exposure values have been statistically evaluated both at their point of maximum and on a profile behind an elevated source and then compared with the values obtained using the stationary models. (DE)

17372 (AED-CONF-74-725-000(Vol.1), pp 246-268) RADIATION EXPOSURE DUE TO THE WASTE AIR OF NUCLEAR FACILITIES IN THE FRG. Bonka, H.; Bruessermann, K.; Schwarz, G.; Brenk, D. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

In nuclear power stations and reprocessing plants, those radionuclides whose retention would be too expensive at the present state of technology are discharged either into the atmosphere through the chimney or, together with the waste water, into the river. The radiation exposure is calculated from the mean emission rates of the most important radionuclides from present and future nuclear power stations and reprocessing plants. In addition to the maximum dose values, superposition effects are discussed by the example of the radiation exposure to noble gases in the FRG. For these calculations, the FRG was subdivided in a scanning pattern with a distance of 2 km. The data show that higher radiation loads near nuclear power stations are only caused by radioiodine. For future large reprocessing plants, separator systems will be necessary. (DE)

17373 (AED-CONF-74-725-000(Vol.1), pp 269-286) THE FUTURE RADIATION EXPOSURE IN THE LOW PLAIN ON THE UPPER RHINE DUE TO ACTIVITY EMISSIONS FROM NUCLEAR POWER STATIONS AND OTHER NUCLEAR FACILITIES. Handge, P.; Hoffman, F. O. 1974. (In German).

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

With the concentration of nuclear power stations in a relatively small area such as the low plain on the upper Rhine with 20 nuclear power station blocks envisaged in 280 km air-line distance, a precalculation of the potential radiation load of the surroundings of these plants is necessary for efficient planning at future sites. Exact calculations of the radiation exposure to radioactive materials in the waste air from nuclear power stations and nuclear facilities can, of course, only be made for realistic conditions of emission and diffusion. An evaluation of future loads must therefore be based on assumptions on the source strength, the nuclide composition, and the mean annual diffusion conditions which in turn are derived from operational experience with existing power stations as well as meteorological data for the site under consideration. These problems are treated in detail in the present paper, and the results are taken into account in the determination of the radiation load in the surroundings of nuclear power stations and nuclear facilities in the low plain on the upper Rhine. (DE)

17374 (AED-CONF-75-244-001) RISK CONSIDERATIONS IN RADIOLOGICAL PRACTICE WITH REGARD TO THE INDICATIONS FOR AN X-RAY EXAMINATION. Beck, H. R. 1975. 12p. (In German). INIS.

From 16th annual meeting of the Vereinigung Deutscher Strahlenschutzaerzte; Kiel, F. R. Germany (20 Jun 1975).

Will be published in Strahlenschutz in Forschung und Praxis. v. 16. Available from ZAED.

The author states that the basic assumptions of the theory of linear dose-response relationships for radiation damage in all dose regions are outdated by now. Linear extrapolations should therefore be discarded as undifferentiated and speculative and unsuitable for the assessment of the real radiation risk. The case is quite different with their usefulness as safety calculation for the establishment of dose limits. There is no objection to this as long as one bears in mind that the much-invoked safety of linear extrapolations is due to the fact that a non-linear curve with a lower ascent in the small-dose region of x-ray- and γ-radiation has a higher scientific probability. (DE)

17375 (AED-CONF-75-244-006) THE RISK OF HAZARDS IN THE USE OF IONIZING RADIATION AND RADIOACTIVE SOURCES FROM THE POINT OF VIEW OF INTERNATIONAL RECOMMENDATIONS AND NATIONAL LEGISLATION. Wendorff, D. 1975. 15p. (In German). INIS.

From 16th annual meeting of the Vereinigung Deutscher Strahlenschutzaerzte; Kiel, F. R. Germany (20 Jun 1975).

Available from ZAED.

The present consequence of all risk discussions is the establishment of single upper limits for the radiation load of the individual with the qualification that every biological risk must be justified by a biological benefit. In addition, the principle of the smallest possible risk must prevail. For the future, however, more emphasis should be placed on the aspect that definitely small risks in the field of radiation exposure should no longer be reduced at will by unwarrantable efforts, as the society would then run the risk of wasting its working power on just one aim and leaving other, more imminent dangers unconnected with radioactive sources or ionizing radiation unconsidered and untreated. (DE)

17376 (AED-CONF-75-244-009) THE CONCEPT OF RISK AND ITS ASSESSMENT. Brueckner, R. 1975. 25p. (In German). INIS.

From 16th annual meeting of the Vereinigung Deutscher Strahlenschutzaerzte; Kiel, F. R. Germany (20 Jun 1975).

Following a basic definition of the term "risk" as the possibility of a discrepancy between planning and reality, with "risk" referring to the possible failure of an envisaged accomplishment, the disadvantages and benefits of the exposure of humans in medical practice are discussed. The importance of statistics as a factor which helps to come to a decision is mentioned, and the influence of radiation exposure on genetic mutations is stressed as a problem for future studies. (DE)

17377 (AED-CONF-75-244-010) THE RISK OF HAZARDS IN MASS X-RAY EXAMINATIONS. Liebschner, K. 1975. 5p. (In German). INIS.

From 16th annual meeting of the Vereinigung Deutscher Strahlenschutzaerzte; Kiel, F. R. Germany (20 Jun 1975).

With a gonad dose of less than 0.1% according to recent measurements, the contribution of photofluorography to the total genetically significant dose of all methods used in diagnostic radiology is less than 1%. At present, the mean bone marrow dose is about 40 mrad. The author is sure that these dose values may be further reduced by the exploitation of all technical and organizational potentialities such as, e.g., a comparative evaluation of X-ray pictures including more ancient pictures. As only about 10% of the population of the FRG participate in mass surveys of the chest, the genetically significant dose may be assumed to be even smaller, i.e., about 1/100 mrad = 0.00001 r. Add to this the fact that this dose is irradiated in fractions, and you can see that the effect should be equal to zero. (DE)

17378 (GSF-S-347) ANNUAL REPORT 1974. Godt, K. J. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). May 1975. 96p. (In German). INIS.

New important topics in the research and development program in the year 1974 were the determination and assessment of the radiation effect on the population due to external and internal radiation sources, as well as improvements of concepts, methods and standards of radiation protection and radiation measuring techniques. In addition to studies on environmental radioactivity, investigations on the determination of chemitoxic metals in environmental samples were continued. A newly formed work group "Internal Exposition" began with investigations on the deposition and retention of aerosols in the respiratory tract. Studies, amongst others, on physical primary processes of radiation effects, the dosimetry of photons and neutrons, aerosol deposition as well as on-trace analysis in air dust were continued in the framework of research contracts. The project on the investigation of the natural radiation load of the population was concluded. Work on automatic image analysis of cytological and histological preparates was continued. The development program was adapted according to the new guidelines. (DE)

17379 (PB-239735) EFFECTS ON POPULATIONS OF EXPOSURE TO LOW LEVELS OF IONIZING RADIATION. (National Research Council, Washington, D. C. (USA). Advisory Committee on the Biological Effects of Ionizing Radiations). Nov 1972. Contract PH-43-64-44. 227p. NTIS $7.50.

A major review is presented of the effects of low levels of ionizing radiation and the role of such information in measures to protect the public. Contents include: Introduction; needs of the times; sources of ionizing radiation and population exposures; environmental transport and effects of radionuclides; genetic effects of ionizing radiation; effects of ionizing radiation on growth and development; and somatic effects. (GRA)

17380 (PB-239982) USE OF METHOTREXATE AND TELEGAMMATHERAPY IN ESOPHAGEAL CANCER. Kusherbaev, S. K.; Dementeva, N. I.; Zhangarashev, K. S.; Tsoi, A. I.; Balmukhanov, S. B. Translated from Vopr. Onkol.; 20: No. 4, 23-28(1974). 13p. NTIS $3.25.

The use of methotrexate in 4 mg. doses 2 or 6 hours before telegamma therapy greatly accelerates and intensifies tumor regression in the esophagus. Treatment of esophageal cancer patients with methotrexate, combined with telegamma therapy using the split course method greatly improves and lengthens the life-span of patients as opposed to patients treated only with irradiation. The clinico-roentgenologic evaluation of direct results of drug-irradiation therapy greatly exceeded results of telegamma therapy alone. (GRA)

17381 EXPANSION OF RADIOLOGY AND RADIOPROTECTION: A COST-BENEFIT BALANCE. Puijlaert, C. B. A. J. (Rijksuniversiteit, Utrecht). pp 416-419 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

An introduction is given into the cost-benefit analysis of X-ray examinations, taking into account both the hazards following exposure to ionizing radiation and the cost of the procedures.

17382 SITUATION OF THE RADIOLOGIST IN THE HOSPITAL ENVIRONMENT. Misono, K. (National Inst. of Radiological Sciences, Chiba, Japan); Nobechi, T. pp 420-425 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

In Japan a great part of biomedical radiography is performed by non-specialized medical doctors. It is shown that radiological investigations carried out by these non-specialists increase the genetically significant dose of the Japanese population considerably. (NL)

17383 THREE-DIMENSIONAL OPTIMIZATION IN INTRACAVITARY APPLICATION OF RADIUM AND OTHER SEALED γ SOURCES. Busch, M. (Univ., Marburg, Ger.). Excerpta Med. Int. Congr. Ser.; 2: 658-661(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Some methods for three-dimensional optimization in intracavitary radiation treatment are described. Radiobiological and clinical experience demonstrates the necessity of optimization in the clinical use of sealed radioactive sources. (NL)

17384 DEPARTMENTS OF RADIATION PHYSICS: ORGANIZATION, STAFFING, AND FACILITIES. Walstam, R. (Karolinska Sjukhuset, Stockholm). pp 485-489 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

The organization of a radiation physics department and its place in hospitals is discussed. (NL)

17385 BIOCHEMICAL INDICATIONS OF IRRADIATION. Dienstbier, Z.; Buric, L. (Charles Univ., Prague). pp 604-607 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A review is given of the urine analysis of those chemical compounds that might serve as quantitative indicators for absorbed radiation doses in man. (NL)

17386 APPLICATION OF CHROMOSOME ABERRATION ANALYSIS TO PROBLEMS IN RADIOBIOLOGY. Dolphin, G. W.; Lloyd, D. C.; Purrott, R. J. (National Radiological Protection Board, Harwell, Eng.). pp 608-613 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Chromosomal aberrations in peripheral blood lymphocytes can be used to estimate the absorbed radiation dose in man. The method might be useful in establishing biological damage in man after radiation through newly developed methods e.g., negative π meson beams. (NL)

17387 INFLUENCE OF RADIATION THERAPY ON THE IMMUNE STATUS OF CANCER PATIENTS. Hoerni, B. (Fondation Bergonie, Bordeaux). pp 630-632 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Delayed radiation effects of radiotherapy on the immune response of cancer patients are reviewed. (NL)

17388 LONG-TERM EFFECTS OF THERAPEUTIC IRRADIATION ON LIVER FUNCTION. Keyeux, A. (Univ., Louvain, Belg.). pp 642-649 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Plasma clearance of several radiopharmaceuticals by the liver is used as a test of liver function after irradiation of this organ. (NL)

17389 LONG-TERM EFFECTS OF THERAPEUTIC IRRADIATION ON THE LUNG. Phillips, T. L.; Margolis, L. W.; Wara, W. M. (Univ. of California, San Francisco). pp 650-657 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A survey is given of delayed radiation effects in the lungs of rodents and of man. The incidence of pneumonitis decreases with increased fractionation of the dose. (NL)

17390 HYPERBARIC OXYGEN IN RADIOTHERAPY, 1973. Dische, S. (Mount Vernon Hospital, Northwood, Eng.). pp 661-664 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Trials have been undertaken to investigate whether irradiation in hyperbaric oxygen would give better clinical results in radiotherapeutically treated cancer patients. Until now, the results seem hardly promising. (NL)

17391 PRESENT STATUS OF HIGH-PRESSURE OXYGEN IN RADIOTHERAPY. Lindberg, R. D.; Fletcher, G. H.; Caderao, J. B. (Anderson Hospital and Tumor Inst., Houston, TX). pp 665-670 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Preliminary data show no advantage of the use of hyperbaric oxygen in the treatment of patients with advanced carcinoma of the cervix uteri using daily fractionation. (NL)

17392 RADIATION THERAPY WITH NEGATIVE PIONS: A PROPOSAL FOR CLINICAL TRIALS. Wideroe, R. Excerpta Med. Int. Congr. Ser.; 2: 417-421(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Using the two-component model of radiation, a successful treatment scheme for electron therapy is analyzed and the number of surviving tumor cells calculated. The conversion of anoxic to euoxic cells, which is not well known, is of decisive importance. This uncertainty can be much reduced when negative pions are used. A scheme whereby pions supplement an initial electron program is considered and calculated. The pion beam needs no cleaning from electron contamination but the magnitude of electron doses must be measured. (NL)

17393 EVALUATION OF CELLULAR REPAIR OF HUMAN SKIN AS A FUNCTION OF THE DOSE PER FRACTION. Wambersie, A. (Univ., Louvain, Belg.); Beauduin, M.; Dutreix, J. Excerpta Med. Int. Congr. Ser.; 2: 201-204(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A comparison is made of skin reactions in the same patient on two symmetrical fields irradiated on one side with a single dose and on the other side with two equal fractions, separated by a time interval varying from six to twenty-four hours. No significant differential effect related to fraction number and time interval could be observed. (NL)

17394 RELATIONSHIP BETWEEN ISOEFFECT, TOTAL DOSE, AND FRACTION NUMBER FOR HUMAN SKIN REACTION. Dutreix, J. (Institut Gustave Reussy, Villejuif, France); Wambersie, A. Excerpta Med. Int. Congr. Ser.; 2: 205-209(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

For human skin reactions, the variation of the total dose with the number of fractions the overall time being kept constant, undergoes a rapid rise when the number of fractions is small and tends to level off when the number of fractions is large. For dose fractions between 200 and 500 rads, a power law may be an acceptable approximation: the exponent 0.15 would give the best agreement. For doses between 500 and 1000 rads, the exponent would be 0.3; below 200 rad it would be approximately zero. (NL)

17395 POLYCYTHEMIA VERA TREATED WITH ^{32}P WITH MYLERAN: DEVELOPMENT OF CHRONIC GRANULOCYTIC LEUKEMIA WITH CHROMOSOMAL ABNORMALITY IN ONE PATIENT. Stavem, P. (Rikshospitalet, Oslo); Sandnes, K.; van der Hagen, C. B.; Vogt, E. Clin. Genet.; 7: 227-231(1975).

Chronic granulocytic leukemia developed in a 59-year-old woman who had previously received a total of 21 mCi ^{32}P for polycythemia vera. She was treated with Myleran (busulphan) for her chronic granulocytic leukemia. Cytogenetic studies revealed deletion of chromosomes No. 8 and 12, and translocation between 1 and 8. The patient also developed a severe autoimmune hemolytic anemia, for which she received prednisone treatment. She died with a perforated stomach ulcer. (DA)

17396 TECHNIQUE FOR USING LOW MELTING POINT ALLOY FOR INDIVIDUAL PATIENT SHIELDING IN RADIOTHERAPY. Marshall, T. J.; Mott, G. T.; Grieveson, M. H. (Mount Vernon Hospital, Northwood, Eng.). Br. J. Radiol.; 48: No. 575, 924-926(Nov 1975).

Accurate individual patient shielding has been used in radiotherapy for a number of years, and in particular in the mantle treatment of Hodgkin's disease. A description is given of a technique for the preparation of individual shielding blocks cast in a high density low melting point alloy (Cerrolow 117, density $8 \cdot 9\ gcm^{-3}$, m.p. $47 \cdot 5°C$, made by Mining and Chemical Products Ltd. using a polystyrene cut-out mold. Economies in the high initial cost of the Cerrolow may be made by introducing re-usable lead plugs into any large shielding blocks, thereby reducing the volume of Cerrolow needed. Little or no wastage of Cerrolow occurs in the casting process and the blocks can be remelted. Repeated use of the alloy alters its composition, resulting in an increased melting point, but the manufacturers can supply suitable additives to restore the original composition. The technique has advantages of convenience, safety and accuracy over alternative methods of preparing shielding blocks. (UK)

17397 EFFECT OF RADIOPROTECTIVE BIOGENIC AMINES ON LIPID PEROXIDATION IN MICROSOMES OF RAT SMALL-INTESTINE MUCOSA. Sobolev, A. S.; Merzlyak, M. N.; Zhamsaranova, S. D.; Goncharenko, E. N.; Kudryashov, Yu. B. (Moscow State Univ.). Dokl. Biophys.; 222: 83-85(1975).

Translated from Dokl. Akad. Nauk SSSR; 222: No. 2, 476-479 (May 1975).

Results of experiments showed that the reduction of peroxide production in the ascorbate-dependent peroxidation system could be attributed to direct interaction of biogenic amines with lipid peroxides. It was found that serotonin inhibits $NADPH_2$ oxidation by liver microsomes; this suggests that serotonin can inhibit enzymic lipid peroxidation. Data indicated that biogenic amines inhibited lipid peroxidation in endoplasmic reticulum membranes, and that a possible reason for the inhibiting effect was the trapping of the superoxide anion-radical O_2^-. Hence the amine- induced lowering of the level of lipid peroxidation products will lead to an enhancement of cell radioresistance. (HLW)

17398 ALTERATION OF THE CONTENT OF NUCLEIC ACIDS IN THE BLOOD OF PATIENTS WITH CANCER OF THE ESOPHAGUS AND STOMACH IN RADIATION TREATMENT OF 25 MeV BETATRON. Fridlyand, I. B.; Ginzburg, M. B.; Kornev, I. I.; Zverev, M. P.; Preobrazhenskii, Yu. V. (Moscow Scientific-Research Rentgeno-Radiological Inst.). Med. Radiol.; 16: No. 1, 22-28(Jan 1971). (In Russian).

The content of nucleic acids and leukocyte count were studied in patients with cancer of the esophagus and stomach before and during radiation treatment of 25 MeV betatron. A definite correlation was noted between the clinical effect of treatment and the content of nucleic acids in the blood: in cases of direct favorable effect of treatment in the first half of the latter the authors noted a reduction of the content of nucleic acids and then a gradual rise. In progress of the neoplastic process the level of nucleic acids in the blood steadily declines. The leukocyte count showed that there exists no correlation between the number of leukocytes and the content of nucleic acids in the blood. (auth)

17399 INVESTIGATION OF CHROMOSOMAL ABERRATIONS IN LEUKOCYTES OF THE PERIPHERAL BLOOD. Tsaranova, L. I.; Bochkov, N. P. (Inst. of Medical Radiology, Obninsk, USSR). Med. Radiol.; 16: No. 1, 29-35(Jan 1971). (In Russian).

The article is concerned with data on the incidence of chromosomal aberrations in peripheral blood leukocytes in gamma irradiation during one course of treatment instituted in two groups of oncological patients. The results derived were compared with data of in vitro irradiation. The level of chromosomal aberrations was similar in all groups and in all doses, and ranges within 1%. Consequently, irradiation does not induce in vivo chromosomal aberrations. Dicentric and circular chromosomes are always

accompanied by one pair of fragments, i.e., a complete asymmetric exchange takes place. Since the lymphocyte population in the referred to doses in partial irradiation of the body is too heterogenic, it is inexpedient to calculate equations and coefficients of aberrations. The number of cells with aberrations in both groups of patients has a dependence which significantly differs from linear. In patients with esophageal tumor all indices of the number of aberrations may be described by equations of linear dependence, this meaning the sum of results of the effect of each fraction. In patients with tumor of the urinary bladder the linear dependence follows only the number of fragments this, apparently, explaining the artificial reduction in the number of affected cells. An analysis of the quantity and types of chromosomal aberrations enables one to conclude that injuries of chromosomes do not stabilize directly after irradiation. The authors established the mean dose for lymphocytes and part of the irradiated blood during the first irradiation. In patients with esophageal tumor $\frac{1}{3}$ to $\frac{1}{4}$ part of the blood was irradiated with a dose of 25 to 50 R, in the second group $\frac{1}{6}$ to $\frac{1}{7}$ part of the blood with a dose of 50 to 100 R. (auth)

17400 COMPARATIVE ASSESSMENT OF DIFFERENT METHODS OF RADIATION THERAPY OF RELAPSES OF MILK-DUCT CARCINOMA. Kozlova, A. V. (Moscow Scientific-Research Inst. of Roentgenology and Radiology). Med. Radiol.; 16: No. 2, 37-41(Feb 1971). (In Russian).

The paper deals with an analysis of 58 cases of relapse of milk-duct carcinoma occurring at different periods (from 1 to 15 to 20 years) after the operation. Relapses were treated by means of the radiosurgical method, intratissular, application and telegammatherapy, as well as with the aid of intratissular betatherapy with the use of ^{198}Au. In the radiosurgical method with the use of gamma-emitting preparations the total dose comprised 4500 to 5000 rad, in all types of gammatherapy—5000 to 6000 rad, in intratissular betatherapy the dose in complete decay of the isotope—20000 to 50000 rad. The effect of the clinical treatment of the relapse and the duration of the follow-up of patients are evaluated depending on the spread of the recurrent neoplastic process and upon the mode of therapy. (auth)

17401 EXCRETION OF GLUCOCORTICOIDS AND THEIR METABOLITES IN PERSONS WORKING WITH SOURCES OF IONIZING RADIATION. Kogan, I. A.; Brestovitskaya, I. Ya.; Shreiberg, G. L. (Kharkov Scientific-Research Inst. of Medical Radiology). Med. Radiol.; 16: No. 2, 41-43(Feb 1971). (In Russian).

The authors studied the fractional content of glucocorticoid metabolites by means of thin-layer chromatography on silicagel in persons working with different sources of ionizing radiation. A total of 92 persons, including 36 persons of the control group, were examined. In accordance with the total dose of irradiation all the examinees were divided into four groups: first group—5 to 30 R, second group—30 to 70 R, third group—70 to 150 R, and fourth group—150 to 400 R. In persons working in conditions of maximally permissible levels the excretion of tetrahydroderivatives did not change. In a significant increase of the radiation dose (fourth group) the excretion of cortisol and cortisone sharply declines and their metabolism is disturbed. (auth)

17402 EXCRETION OF DESOXYCYTIDINE IN PATIENTS WITH LEUKEMIA AFTER TOTAL GAMMA IRRADIATION. Tarakanova, M. P. Med. Radiol.; 16: No. 2, 44-46(Feb 1971). (In Russian).

Studies of the excretion of desoxycytidine in two patients with acute leukemia (myeloblastic and lymphoblastic variants) subjected to total whole-body irradiation in doses of 250 and 150 R revealed a biphasic rise of excretion during the 1st to 2nd and 6th to 11th day after irradiation. In the first 1 to 2 days the urinary content of desoxycitidine in both patients increased by two times as compared to the preradiation level. A maximal excretion was observed in a patient irradiated during total metaplasia of the bone marrow in 96% content of blastic cells in the peripheral blood at the end of the first 24 hours, whereas in the patient irradiated at the time of complete clinico-hematological remission—on the 7th to 8th day after gamma therapy. (auth)

17403 EFFECT OF SULFHYDRYL COMPOUNDS ON THE RADIATION LOAD IN WOMEN RECEIVING RADIOTHERAPY. Michalica, W.; Kellner, G. (Univ., Vienna). Wien. Med. Wochenschr.; 86: No. 6, 151-153(22 Mar 1974). (In German).

In women with collum carcinoma it was attempted to reduce the load of conventional radium and X-ray therapy by administration of Reducdyn®, which is effective in animal experiments. The results were negative according to the method of iodine and bromide consumption. The discrepancy in the effects in animals and humans is suggested to be a result of differences in doses. (auth)

17404 HAZARD CONTROL POLICY IN BRITAIN. Chicken, J. C. Oxford; Pergamon Press (1975). 193p.

The aim of the book is to examine the general nature of the policy making process of hazard control in Britain, as it appeared at the beginning of the nineteen seventies, prior to the implementation of the Health and Safety at Work Act of 1974. The general view of hazards control policy is built up from case studies of five activities: road transport, air transport, factories, nuclear power reactors, and air contamination. The analysis is divided into three main parts: the nature of hazards, hazard control policy, and the role of interest groups, i.e., groups that aim to influence policy. The examination of these interest groups is based on a review of the relevant literature and on data obtained from a questionnaire to twenty-seven such groups. (UK)

17405 METHOD OF PERSONAL EXPOSURE MEASUREMENT IN WORKPLACES WITH A SOURCE OF EXTERNAL RADIATION. Chysky, J.; Trousil, J. Radioisotopy; 15: No. 2, 301-306(1974). (In Czech).

On the basis of 10 years of experience with personal dosimetry performed in monthly intervals, the authors suggest to measure exposure in less risky workplaces in 2 to 3 month intervals and to continue with monthly measurements in hazardous workplaces, and to complement film dosemeters with accident dosimetry. (auth)

17406 INTERNATIONAL COMPARISON OF MEASUREMENT PRECISION OF PERSONAL EXPOSURES TO IONIZING RADIATION. Hecker, O.; Kraus, W.; Musialowicz, T.; Referowski, Z.; Rothe, W.; Singer, J.; Trousil, J.; Wysopolski, J. Radioisotopy; 15: No. 3, 401-413(1974). (In Czech).

The authors present the results of an international comparison of exposures to x ray and gamma radiation ranging from 15 keV to 1.25 MeV and from 50 mR to 20 R measured with personal film dosemeters. The results confirm the possibility of mutual comparison of occupational exposures to ionizing radiation in the participating countries. (auth)

17407 OCCUPATIONAL EXPOSURE TO IONIZING RADIATION IN CSSR. Chysky, J.; Trousil, J. Radioisotopy; 15: No. 3, 367-373(1974). (In Czech).

The results of personal dosimetry in the years 1966 to 1970 were subjected to a statistical analysis. The authors found higher exposures in industry (defectoscopy) than in the health service, while in the health service the exposure was higher in departments of oncology and in women. Exposures are also higher in less skilled workers and in larger workplaces. (auth)

17408 EXPOSURES TO IONIZING RADIATION. Hecker, O.; Jankowski, J.; Kodl, O.; Kraus, W.; Musialowicz, T.; Referowski, Z.; Rothe, W.; Singer, J.; Trousil, J.; Wysopolski, J. Health Phys.; 26: No. 4, 349-351(1974).

Workers from Poland, the GDR, and Czechoslovakia performing film dosimetry on a national scale have compared the calibration of films by means of roentgen, gamma, and mixed radiation for exposures ranging from 50 to 2000 mR. Errors exceeded in no case ±30%. (auth)

17409 SYSTEM FOR ESTIMATION OF MEAN ACTIVE BONE MARROW DOSE. Ellis, R. E.; Healy, M. J. R.; Shleien, B.; Tucker, T. DHEW Publication (FDA) 76-8015. Rockville, MD; Department of Health, Education, and Welfare (1975). 58p. GPO $1.15.

The exposure measurements, model and computer program for estimation of mean active bone marrow doses formerly employed in the 1962 British Survey of x-ray doses and proposed for application to x-ray exposure information obtained in the U. S. Public Health Service's X-Ray Exposure Studies (1966 and 1973) are described and evaluated. The method described is feasible for use to determine the mean active bone marrow doses to adults for examinations having a skin to source distance of 80 cm or less. For a greater SSD, as for example in chest x rays, a small correction in the calculated dose can be made. (auth)

17410 SYMPTOMS OF RADIATION DISEASE IN SURVIVORS. II. Damage and Casualties Caused by Atomic Bomb Explosions. Szirmai, E. (Inst. of Nuclear Engineers, London); Medgyesy, G. J. Inst. Nucl. Eng.; 16: No. 5, 143-147(Sep 1975).

The subject is discussed under the following headings: thermal injuries; radiation injuries; course and sequence of the injuries after the explosions; acute injuries; chronic injuries; and genetic damage. Emphasis is on the late effects of the explosions. (UK)

17411 SIMPLIFIED EXPRESSION FOR THE CONTRIBUTIONS OF RADIOACTIVE DAUGHTERS TO THE EFFECTIVE DECAY ENERGIES OF CHAINS. Shepherd, J. G. (Ministry of Agricul-

ture, Fisheries, and Food, Lowestoft, Eng.). Health Phys.; 29: No. 5, 805-808(Nov 1975).

To take into account the disintegration energies of radioactive daughters when evaluating the doses delivered by internally deposited radionuclides which are the parents of decay chains the effective energy of the ith daughter must be modified by a factor F_i. This factor represents essentially the ratio of the number of disintegrations of the daughter to the number of disintegrations of the parent occurring in a given time. The two cases of chronic irradiation over a time T and of cumulative dose over the same time T after a single intake are considered. An extremely simple form of F_i which clearly exhibits the physical significance of the equations, is readily calculable by hand or machine and which is fairly accurate, is derived. The interpretation and use of the simplified form is discussed. (UK)

17412 RESULTS OF TREATMENT OF CERVIX UTERI CARCINOMA WITH COBALT-60 BY "AFTERLOADING" TECHNIQUE. Marzecki, Z.; Torbe, Z.; Szalabawka, L.; Gniewosz, Z. Rocz. Pomor. Akad. Med. Szczecinie; 20: 285-291(1974). (In Polish)

In the paper, the results of intracavitary irradiation of cervix uteri carcinoma with cobalt-60 by afterloading technique were presented. Manchester method of treatment was used. During the period of seven years 836 cases were irradiated I°-69, II°-348, III°-194, IV°-11, postoperative irradiation-214). The results of treatment were provided in two groups of patients. The five-year survival in the group of 150 patients treated during the first two years of applying the method claimed 55.3% (I°-100%, II°-50.0%, III°-30.2%, IV°-0%, the postoperative irradiation-76.7%). The three-year survival in the group of 238 patients treated during the next two years was 62.2% (I°-96%, II°-68.6%, III°-33.3%, IV°-0%, postoperative irradiation-78.0%). (auth)

17413 POSSIBILITIES OF REDUCING THE RADIATION EXPOSURE IN TAKING CONTACT RADIOGRAPHS OF THE TEMPOROMANDIBULAR JOINT WITH THE AID OF THE PARMA TECHNIQUE. Wiltschke, F. (Ernst-Moritz-Arndt-Univ., Greifswald, Ger.). Stomatol. DDR; 24: No. 12, 801-807(Dec 1974).

The contact or short-distance radiography of the temporomandibular joint as described by Parma in 1929 is inconsistent with the radiological protection regulations in force. Consequently, it must be rejected. Nevertheless, the author holds the view that this technique, which is indispensable to stomatologists and oral surgeons at the time being, may be employed if special protective measures are taken. It is dosimetrically evidenced that, apart from covering the patient with protective clothing, the most important of these measures consists in using a flat tube whereby the cutaneous and the gonadal exposures are reduced by 70 and 90%, respectively. The practical manufacture of such a flat tube and its use are described; its industrial production is recommended. (auth)

17414 EFFECTS OF IONIZING RADIATION ON MAN. Watson, G. M. At. Energy Aust.; 18: No. 4, 1-11(Oct 1975).

This paper describes the major effects of ionizing radiation on man and the relationship between such effects and radiation dose, with the conclusion that standards of radiological safety must be based on the carcinogenetic and mutagenic properties of ionizing radiation. Man is exposed to radiation from natural sources and from man-made sources. Exposure from the latter should be regulated but, since there is little observational or experimental evidence for predicting the effects of the very small doses likely to be required for adequate standards of safety, it is necessary to infer them from what is seen at high doses. Because the formal relationship between dose and effect is not fully understood, simplifying assumptions are necessary to estimate the effects of low doses. Two such assumptions are conventionally used; that there is a linear relationship between dose and effect at all levels of dose, and that the rate at which a dose of radiation is given does not alter the magnitude of the effect. These assumptions are thought to be conservative, that is they will not lead to an underestimation of the effects of small radiation doses although they may give an overestimate. (auth)

17415 RADIATION HAZARDS IN URANIUM MINING AND MILLING. Fry, R. M. At. Energy Aust.; 18: No. 4, 12-31 (Oct 1975).

As well as the need to control the more conventional hazards associated with any mining and milling operation, special care must be exercised in the mining and milling of uranium because of the radioactive nature of the ore. Uranium ore, though only mildly radioactive, contains a complex mixture of radioactive isotopes, behaviour of which during each phase of the mining and milling process, determines controls that must be established to ensure safe working conditions. (auth)

17416 THYROTOXICOSIS: A RADIONUCLIDE DOSIMETRY. Richards, P. A. C. (Launceston General Hospital, Tasmania, Australia). Radiographer; 22: No. 2, 48-51(Jun 1975).

An increasing number of toxic goitres treated with ^{131}I sodium iodide in Launceston, Tasmania, have returned at periods of 6 to 18 months presenting with hypothyroidism. In order to reduce this incidence, ^{131}I dosimetric calculations were undertaken that would yield a delivered dose of 8500 rads to the toxic gland. A number of factors influence the delivered dose to the thyroid gland which will be discussed to show that calculations can be made to give an estimated absorbed dose (rads) as an aid to the management of thyrotoxicosis. (auth)

17417 PERSISTENT CHROMOSOME ABERRATIONS FOLLOWING A RADIATION ACCIDENT. Todorov, S. Acta Med. Bulg.; 2: No. 1, 58-63(1974).

Cytogenetic analysis was made of the structural chromosomal aberrations in 52- and 72-hour lymphocyte cultures obtained from two individuals directly involved in an accident with radium-226. The importance of 52-hour cultures for the quantitative cytogenetic analysis is emphasized. Experimental data showed a tendency toward decrease in the number of structural chromosomal aberrations by the 10th month after the accident by approximately 30% ± 3.1%, as compared with their number immediately after the accident. Systematic assay of persistent chromosomal aberrations is considered necessary not only for the needs of "biologic dosimetry", but also for their possible role in late radiation sequelae. (auth)

17418 INFLUENCE OF X IRRADIATION ON THE QUANTITY OF CHROMOSOME ABERRATIONS IN HUMAN PERIPHERAL BLOOD LYMPHOCYTES. Todorov, S.; Mileva, M.; Bulanova, M.; Ivanov, V. Acta Med. Bulg.; 2: No. 1, 97-104(1974).

Quantitative analysis was made of the structural derangements in the chromosomes of human peripheral blood lymphocytes exposed to 180 Kv x radiation in doses of 25, 50, 100, 200, 250, 400, and 500 rad at a dose rate of 68 rad/min. Statistical processing of the experimental data by means of the least squares method demonstrated a regression dependency well describable by the mathematical model $Y = a + vD$ for the chromosome fragments and cells with structural aberrations, and by the model $Y = sD^p$ for dicentrics, interstitial deletions, rings, total number of aberrations and total number of breaks. The reference curves constructed on the basis of these mathematical models may be useful in case of accidents in x-ray therapy. (auth)

17419 ROLE OF NATURAL RADIATIONS IN HUMAN LEUKEMOGENESIS. Jacobson, A. P.; Plato, P. A.; Frigerio, N. A. Am. J. Public Health; 66: No. 1, 31-37(Jan 1976).

Some 3 billion years ago, life arose from a warm pool of primordial ooze amid a constant drizzle of radiation. Steadily, man evolved from the lesser forms of life because of or in spite of his natural background-radiation environment. This study is an attempt to determine to what extent these background radiations are responsible for human disease, namely leukemia. Dose rate data were compared with data on all forms of leukemia in the 50 United States for four population subgroups. For the total U. S., no relation between background radiation and leukemia is apparent. A positive correlation appears, however, if various states are deleted from the analysis. It appears that conditions relative to populations and their environment could mask a radiation effect if in fact one is present. (auth)

17420 COSMIC RADIATION EXPOSURE IN SUPERSONIC AND SUBSONIC FLIGHT. Aviat., Space Environ. Med.; 46: 1170-1185 (Sep 1975).

The main body of this document consists of four major sections: (1) an introduction describing the scope of Committee operations and proving a brief exposition of the concepts of radiation protection; (2) a survey of experimental and theoretical data on cosmic radiations that have been obtained in individual research projects with emphasis on investigations that were performed under the sponsorship of the Committee. The studies evaluate galactic and solar radiation as a function of altitude and magnetic latitude; (3) best current estimates of cosmic radiation levels in the atmosphere; and (4) radiation protection recommendations dealing with maximum permissible doses and operational aspects covering satellite warning systems, on-board instrumentation, and forecasting. Nine annexes submitted by individual authors cover various of these subjects in greater detail. (auth)

Vertebrates

Refer also to abstracts 17302, 17307, 17308, and 17947.

17421 (CRSSA-1973, pp 20-21) EFFECT OF GAMMA TOTAL IRRADIATION OF RATS ON OXIDOPHOSPHORYLATION MECHANISMS OF HEPATIC MITOCHONDRIA. Tine, J.; Lienard, F.; Dugas du Villars, J.; Rocquet, G. [nd]. (In French).

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75 – Paris (France)).

The effects of gamma total irradiation (lethal dose) on various respiratory states of hepatic mitochondria are studied. Animals are killed, 1 to 4 days after irradiation. (FR)

17422 (CRSSA-1973, pp 25-27) STUDY OF URINARY EXCRETION OF ACETIC 5 HYDROXYINDOLE ACID AFTER IRRADIATION. Valle, C.; Arsac, F. [nd]. (In French).

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75 – Paris (France)).

The set up for a reliable and relatively quick determination method to quantitatively follow urinary clearance changes of acetic 5 hydroxyindole acid, after whole-body irradiation by gamma rays of a cobalt-60 source, is described. (FR)

17423 (CRSSA-1973, pp 28-30) VARIATIONS IN ACTIVITY OF SEROUS TRANSAMINASES AFTER IRRADIATION IN RAT AND RABBIT. Breuil, L.; Caze, O. [nd]. (In French).

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75 – Paris (France)).

The serous transaminases present after gamma ray irradiation from cobalt 60 are studied. Their possible usefulness in biological dosimetry is underlined. (FR)

17424 (CRSSA-1973, pp 31-33) VARIATIONS IN ACTIVITY OF DIFFERENT ENZYMES (CHOLINESTERASE, ALKALINE PHOSPHATASE, LACTICODEHYDROGENASE) IN RAT SERUM AFTER GAMMA IRRADIATION. Breuil, L.; Marquer, G. [nd]. (In French).

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75 – Paris (France)).

A biochemical indicator for biological damage after irradiation is searched (this indicator must respond early enough). (FR)

17425 (CRSSA-1973, pp 33-35) EVOLUTION IN ACTIVITY OF ACID PHOSPHATASE IN IRRADIATED MICE LIVER. Histophotometric Study. Neveux, Y.; Gounon, P.; Drouet, J.; Guillouzo, A. [nd]. (In French).

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75 – Paris (France)).

Enzymatic kinetics of hepatic acid phosphatase, enzyme labeling of lysosome, is studied during a whole-body irradiation and before assaying in injuries. (FR)

17426 (CRSSA-1973, pp 35-39) HEPATIC CATALASE ACTIVITY AFTER WHOLE-BODY IRRADIATION OF THE MOUSE. Neveux, Y.; Drouet, J.; Guillouzo, A.; Rault, H.; Picard, G. [nd]. (In French).

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75 – Paris (France)).

Using biochemical techniques, the effect of irradiation on catalase rate of different tissues is studied. With cytochemistry, the decrease of catalase activity is studied in situ, after exposure to great ionizing radiation doses. (FR)

17427 (CRSSA-1973, pp 40-41) INFLUENCE OF A γ SUBLETHAL WHOLE-BODY IRRADIATION UPON UNITARY ACTIVITIES OF THE DORSAL HIPPOCAMPUS. Preliminary Results. Bassant, M. H.; Court, L. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75–Paris (France)).

Electrophysiological and mathematical study techniques for unitary analysis of rabbit dorsal hippocampus neurons are applied to the animal exposed to a γ sublethal whole-body irradiation. (FR)

17428 (CRSSA-1973, pp 44-45) VARIATIONS OF IMMUNOGLOBULINS AFTER ANTIGENIC INJECTION IN IRRADIATED RABBIT. Servant, P.; Borgard, J. P.; [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75–Paris (France)).

Study on the influence of irradiation upon rabbit immunoglobulins is developed. It is tried to check if the observed delay, after cephalic irradiation, in specified antibody response of injected antigen, could be in relation with a transient hypoimmunoglobulinemia in these same animals. (FR)

17429 (CRSSA-1973, pp 45-46) INFLUENCE OF IRRADIATION UPON NEONATIVE TOLERANCE STATE INDUCED IN RABBIT. Servant, P.; Marquer, C. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75–Paris (France)).

An attempt was made to determine the effect of whole-body irradiation on the establishment of a state of tolerance in newborn rabbits by the intraperitoneal injection of 1mg of human serum albumin. Simultaneous irradiation (doses of 200, 150, 100 rads) and antigen injections inhibited the establishment of this tolerance. (FR)

17430 (CRSSA-1973, pp 47-48) EFFECT OF A CEPHALIC IRRADIATION ON HUMORAL IMMUNITARY RESPONSE IN ADULT RABBIT. Servant, P.; Marquer, C. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75–Paris (France)).

In connection with the origin and mechanisms of immunitary depression due to irradiation, it is tried to find if changes of humoral immunitary response could be caused by a limited irradiation of central nervous system. (FR)

17431 (CRSSA-1973, pp 83-85) STUDY OF RADIOPROTECTIVE POWER OF PHENYLHYDRAZINE. Fatome, M.; Bernard, P. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75–Paris (France)).

Radioprotective power of phenylhydrazine is the result of increase of number of hematopoietic cells in spleen at the time of irradiation. (FR)

17432 (CRSSA-1973, pp 85-86) RADIOPROTECTIVE ACTION OF C_{811} INJECTED 24 HOURS BEFORE LETHAL IRRADIATION. Fatome, M.; Bernard, P. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75–Paris (France)).

C_{811} injected 24 hours before irradiation keeps a non negligible part of its radioprotective power, unlike cysteamine. It is tried to confirm this characteristic by experiments. (FR)

17433 (CRSSA-1973, pp 86-88) INFLUENCE OF CYSTEAMINE AND A MIXTURE OF RADIOPROTECTORS ON POLYNUCLEATES AND LYMPHOCYTES IN IRRADIATED MOUSE. Fatome, M.; Bernard, P. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75–Paris (France)).

The diminution of the number of peripheral blood white elements is one of the consequences of ionizing radiation action on organism, even at sublethal doses. The drop of these white elements and their possible recovery in irradiated animal, which have received before a radioprotective substance, are studied. The results obtained are compared with these found in non-protected animal. (FR)

17434 (CRSSA-1973, pp 89-90) ACTION OF MECLOFENOXATE ON GLYCEMIC COMPENSATION DISORDERS CAUSED BY IRRADIATION. Rouif, J.; Probst, A.; Bourguignon, J. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75–Paris (France)).

Besides analysis of glycemia disorders after irradiation, it is shown that one of the impact points of this irradiation is the drop of glucose assimilation coefficient (K). It is checked that meclofenoxate, being able to correct certain neurovegetative reactions after irradiation, can also protect the animal against glucidic metabolism injury. (FR)

17435 INCREASED REACTIVITY OF RAT ALPHA-FOETOPROTEIN WITH CORRESPONDING ANTISERUM AFTER ^{125}I LABELLING. Dambuyant, C.; Sizaret, P. (Centre International de Recherche sur le Cancer, Lyon). J. Immunol. Methods; 8: No. 3, 289-294(Sep 1975).

17436 HYPERBARIC OXYGEN AND RESPONSE OF TUMORS IN EXPERIMENTAL ANIMALS TO IONIZING RADIATION. Suit, H. D. (Massachusetts General Hospital, Boston). pp 658-660 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A review is given of data demonstrating that tumors in the laboratory animal have hypoxic but viable and highly radiation-resistant cells which determine the tumor's lethal response to local irradiation. In several of these tumor systems there exist strong indications that significant reoxygenation occurs during the course of fractionated irradiation. The use of hyperbaric oxygen, though, usually effects a prominent augmentation of radiation damage to tumors. (NL)

17437 LATE EFFECTS OF THERAPEUTIC IRRADIATION ON CORONARY ARTERIES IN THE RHESUS MONKEY. Keijser, A. H. (Gezondheidsorganisatie TNO, Rijswijk, Netherlands). pp 640-641 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Lesions of the coronary arteries have been found in rhesus monkeys treated with radiation schedules as employed in patients with malignant tumors in the thoracic area. These findings in subhuman primates may indicate that human coronary arteries are susceptible to developing atherosclerosis-like lesions after therapeutic irradiation. (NL)

17438 LONG-TERM EFFECTS AFTER X-RAY EXPOSURE OF THE SPINAL CORD. van der Kogel, A. J.; Barendsen, G. M. (Gezondheidsorganisatie TNO, Rijswijk, Netherlands). pp 637-639 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

With increased dosage, the period between irradiation and the appearance of damage symptoms in the spinal cord shortens with a minimum value of about four months. Fractionation has a considerable sparing effect with X-rays but with neutrons the effect is minimal. (NL)

17439 RECOVERY OF THE IMMUNE SYSTEM AFTER IRRADIATION. Doria, G.; Gorini, G.; de Michele, A. (CNEN, Casaccia, Italy). pp 633-636 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A review is given of the effects of high radiation doses on the recovery of the immune system. (NL)

17440 EFFECT OF RADIATION ON THE LYMPHOID SYSTEM. Vos, O. (Rijksverdidegingsorganisatie TNO, Rijswijk, Netherlands); Zaalberg, O. B. pp 626-629 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

The high radiosensitivity of the lymphoid tissues is mainly due to a high interphase death of lymphocytes. The lymphoid tissues functionally show a high radiosensitivity as has been observed for other cell renewal systems such as bone marrow, gut and skin. Repopulation of lymphoid tissues with immune responsive precursor cells occurs more slowly than repopulation of hemopoietic tissues with stem cells. (NL)

17441 MODIFICATION OF THE RADIATION EFFECTS ON DNA AT MOLECULAR AND CELLULAR LEVEL BY COMPOUNDS THAT INFLUENCE ITS REPAIR. Lopez Zumel, M. C.; Astudillo, M. D.; Alvarez, M. V. (Instituto Rocasolano, Madrid). pp 618-625 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

At the molecular level, acridine derivatives act on target molecules as protectors by their addition to the targets, thus hindering the radiation hit. Their most important property ought to be that of inhibitor of repair processes and not that of radiosensitizer. (NL)

17442 ENERGY-DEPENDENT REPAIR OF CELLULAR LESIONS. Revesz, L. (Kungliga Karolinska Mediko-Kirurgiska Institutet, Stockholm). pp 614-617 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

The role of oxygen in the expression of radiation damage in cells is a dual one: it acts as an essential modifying agent to lethal damage as well as the accumulation of sublethal damage. The latter action may be closely related to an oxygen-dependent metabolic pathway during or shortly after irradiation. Oxygen, therefore, is sensitizing as well as protecting and the summated result of these opposite actions define the net survival. (NL)

17443 EFFECTS OF LOW DOSE LEVELS OF IONIZING RADIATIONS ON MALE MAMMALIAN GERM CELLS. Leonard, A. (CEEN, Mol, Belg.). pp 590-592 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

It is probable that data on radiosensitivity of male germ cells in mice are applicable to man. This implies that the hazard of exposure to low doses of ionizing radiation is less a threat than one would expect on the basis of extrapolation from the data at high dose levels, since repair may intervene. (NL)

17444 QUINONIC COMPOUNDS AS RADIOSENSITIZERS. Sanz, F.; Partida, P. G.; Astudillo, M. D.; Alvarez, M. V. (Consejo Superior de Investigaciones Cientificas, Madrid). pp 581-584 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Diphenylquinone significantly increased the radiosensitivity of ascites tumors in mice when absorbed radiation dose was 400 rads or more. (NL)

17445 CLASS "A" FISSION-NEUTRON IRRADIATION OF SMALL LABORATORY ANIMALS. Zarand, P. (National Research Inst. for Radiobiology and Radiohygiene, Budapest). Radiat. Res.; 64: No. 2, 344-352(Nov 1975).

Average absorbed dose values were calculated in various small laboratory animals (mouse, rat, guinea pig), using an albedo code, and the uniformity of the irradiation was studied. A plane source emitting neutrons with a cosine distribution was used. The neutron spectrum used was that measured in the irradiation facility of the Hungarian Research Reactor. Infinite-length cylinders with radii 1.25, 2.5, and 3.3 cm were used for calculation. The average absorbed dose was 85.2, 72.1, and 64.9 percent of the free-in-air kerma. None of the irradiations were uniform when unilateral irradiation was assumed. A uniform, Class A irradiation (D/sub max// D/sub min/ less than 1.15) could not be achieved in rats and guinea pigs if only bilateral irradiation or rotation was used. With various field-shaping filters, a very uniform irradiation may be performed, with D/sub max//D/sub min/ less than or equal to 1.05, in all three types of animals. Present calculations were compared with other values (measured or calculated) published in the literature. (auth)

17446 RADIATION-INDUCED DNA STRAND BREAKS AND THEIR REJOINING IN CRYPT AND VILLOUS CELLS OF THE SMALL INTESTINE OF THE MOUSE. Rydberg, B.; Johanson, K. J. (Uppsala Univ.). Radiat. Res.; 64: No. 2, 281-292(Nov 1975).

A sensitive method has been developed for the estimation of DNA strand breaks in the proliferating crypt cells and the differentiated villous cells of the small intestine of the mouse. The method is based on the observation that the rate of denaturation of DNA to single strands in alkali is increased after irradiation, the interpretation being that this effect is due to DNA strand breaks. Various tests and developments of the method, when applied to an in vivo situation, have been made. Using whole-body ^{60}Co gamma irradiation (300 to 2000 rad), the yield of breaks induced per rad and the kinetics of their rejoining in vivo were found to be very similar in the crypt and villous cells. Most DNA strand breaks seemed to be rejoined within 30 min. In contrast with these findings, the crypt and villous cells have very different radiosensitivities when histological criteria are used to estimate, for example, cell death. This difference in radiosensitivity thus seems to be unrelated to the capacity of the cells to rejoin the main fraction of radiation-induced single strand breaks in DNA. (auth)

17447 THYMIC REGENERATION IN LETHALLY X-IRRADIATED MICE. Sharp, J. G.; Thomas, D. B. (Univ. of Birmingham, Eng.). Radiat. Res.; 64: No. 2, 293-305(Nov 1975).

The effects of a lethal dose of 750 rad of whole-body x irradiation on the murine lymphomyeloid complex have been investigated. During the first 4 days after exposure there was a marked decrease in the weight of the thymus, spleen, and lymph nodes and in the cellularity of the femoral bone marrow. Subsequently, a phase of thymic regeneration, maximal on the tenth day, was observed in the absence of detectable regeneration elsewhere in the lymphomyeloid complex. The thymus, from the third to the fifth days postirradiation, although very hypocellular, was a site of extensive tritiated thymidine incorporation indicating the presence of a precursor cell population undertaking DNA synthesis. No comparable changes in the tritiated thymidine incorporation of the spleen, lymph nodes or bone marrow were observed. Thymic regeneration in the absence of detectable regeneration elsewhere in the lymphomyeloid complex occurred over a range of doses within the lethal range in several strains of mice. (auth)

17448 MODIFICATION OF RADIATION LETHALITY BY PREVIOUS TREATMENT WITH BUTYLATED HYDROXYTOLUENE. Clapp, N. K.; Satterfield, L. C. (Oak Ridge National Lab., TN). Radiat. Res.; 64: No. 2, 388-392(Nov 1975).

Young adult BALB/c mice of both sexes were irradiated with 525 to 750 R of x rays with and without a prefeeding of 0.75 per cent butylated hydroxytoluene (BHT) in the feed. In contrast to a previous observation in C31F_1 mice, no potentiation of radiation lethality was observed with BHT treatment in either sex. Instead, a suggestion of radiation protection was observed at all doses below that which produced 100 percent lethality. $LD_{50/30}$ values in females were 628 R for radiation alone and 643 R for BHT plus radiation; LD_{50}'s for males were 581 R for radiation and 622 R for BHT plus radiation. These differences were significant at P less than 0.05 and P less than 0.01, respectively. The difference in effect may be related to the genetic differences between the inbred BALB/c mice and the hybrid C31F_1. (auth)

17449 REPAIR OF POTENTIALLY LETHAL RADIATION DAMAGE IN ACUTE AND CHRONICALLY HYPOXIC TUMOR CELLS IN VIVO. Urano, M.; Nesumi, N.; Ando, K.; Koike, S.; Ohnuma, N. (National Inst. of Radiological Sciences, Chiba, Japan). Radiology; 118: No. 2, 447-451(Feb 1976).

The ability of animal tumor cells to repair potentially lethal damage was studied in vivo. Fifth-generation isotransplants of a spontaneous mouse squamous-cell carcinoma were irradiated under tourniquet-induced hypoxia or in air. Tumors were removed either immediately or 6 hours after irradiation and dose-response curves were determined by TD_{50} assays. Repair was attributed to cells in the hypoxic cell component for animals irradiated in air. Extensive repair was also noted for those irradiated under hypoxic conditions. Implications of these results are discussed. (auth)

17450 RELATIVE BIOLOGICAL EFFECTIVENESS OF NEGATIVE pi MESONS FOR THE IMMUNE RESPONSE IN MICE. Carlson, D. E.; Thornton, J. (Univ. of Texas, Dallas). Radiology; 118: No. 2, 443-446(Feb 1976).

Immunologically competent mouse spleen cells were exposed to negative pi mesons in the entrance plateau or at the peak of the dose distribution at a maximum dosage of 5 rads/min. or to ^{60}Co gamma rays at 4.96 rads/min. Survival curves from cells irradiated in vitro but incubated in vivo yielded RBE values of 2.15 for the peak and 1.84 for the entrance plateau at a surviving fraction of 0.1. The dose-rate dependence of antibody-forming spleen cells for both ^{60}Co gamma rays and the low-LET components of the pion beam is discussed. The authors suggest that these RBE values constitute an upper limit for normal mammalian cells exposed to pions and that the RBE with clinically useful dose rates may be significantly lower than those reported here. (auth)

17451 DOES X RADIATION OF THE PRECONCEPTIONAL MAMMALIAN OVUM LEAD TO STERILITY AND/OR CONGENITAL ANOMALIES. Rugh, R.; Budd, R. A. (Bureau of Radiological Health, Rockville, MD). Fert. Steril.; 26: No. 6, 560-572 (Jun 1975).

It is now well established that x radiation of the developing mammalian embryo or early fetus can lead to congenital anomalies. Incidental to x radiation of the pregnant animal, the gonads of the developing fetus and the adjacent mature gonads of the mother are also exposed. Reports of the effects of such x radiation on the prefertilized ovum and oocytes have appeared, but none has been aimed specifically at determining the degree and onset of sterility and the incidence of resorptions and congenital anomalies. It is the purpose of this study to answer these questions relating both to the immediate effects on the gonads and any persistent postradiation effects on the offspring of the parental stock, as well as sterility and anomalies that might occur among the F_2 generation as a result of brother and sister matings. The results of this study provide experimental insight into the possible consequences to fertilizability of exposure of the unfertilized ovum or earlier oocyte and the possibility that exposure causes the development of congenital anomalies. (auth)

17452 ALTERATION OF THE MEGAKARYOCYTIC-THROMBOCYTIC APPARATUS IN PROLONGED FRACTIONATED IRRADIATION. Babushkina, A. G.; Muksinova, K. N. (Inst. of Biophysics, Moscow). Med. Radiol.; 16: No. 1, 36-40(Jan 1971). (In Russian).

The article presents data on alteration of thromboiesis in Wistar rats in daily fractionated irradiation in a dose of 50 R. There was seen not only a reduction of the absolute peripheral thrombocyte content and bone marrow megakaryocytes in irradiated animals, but also shifts in the thrombocytic and megakaryocytic formula. These changes intensified with increase of the total dose of irradiation. By means of autoradiography with ^{3}H-thymidine it was established that processes of endoreplication of megakaryocyte nuclei in irradiated animals are not disturbed, whereas the maturation of these cells are significantly delayed. (auth)

17453 ERYTHROPOIETIC ACTIVITY OF THE BLOOD IN FRACTIONAL IRRADIATION. Luzanov, V. M.; Muksinova, K. N. (Inst. of Biophysics, Moscow). Med. Radiol.; 16: No. 2, 52-56(Feb 1971). (In Russian).

The work was carried out on male Wistar rats who were daily irradiated with a dose of 50 R on ^{137}Cs gamma-emitter (12.5 R/min) until total doses of 150, 250, 500, 1000, and 2000 R. The erythropoietic activity of the blood of experimental and control animals was determined on a model of polycythemic rats. The blood erythropoietic activity in irradiated animals increases from the first days of irradiation (total dose of 150 R). With accumulation of the total dose of irradiation the erythropoietic activity gradually increases and in total doses of 1000 to 2000 R exceeds the control values by 7 to 17 times. Upon confrontation of data on alteration of the erythropoietic activity and myelopoiesis in these animals the authors noted a distinct correlation. The proliferative activity of erythronormoblasts in the bone marrow increases. The shifts of hematopoiesis in protracted fractional irradiation to a significant measure are due to alteration of the character of humoral regulation. (auth)

17454 EFFECT OF PROTAMINE ADENOSINE TRIPHOSPHATE ON THE SURVIVAL OF RATS FOLLOWING A SINGLE-DOSE LETHAL IRRADIATION. Plantev, T. P.; Bokova, N. V.; Nikolov, I. T. (Scientific-Research Inst. for Radiobiology and Radiation Hygiene, Sofia). Eksp. Med. Morfol.; 12: 186-190(1973). (In Russian).

The authors synthesized adenosine triphosphate salt of protamine, isolated from salmon. They examined the antiirradiation of the preparation on white male rats, irradiated singly by a lethal dose of roentgen rays. As an integral criterium for protection the survival of the experimental animals was used, the mean duration of life and the coefficient of protection. The changes in the dry weight of spleen and intestines as well as the number of nuclear cells of the bone marrow were examined for evaluation of the effect of the preparation on the single syndromes of the irradiation disease. There was a considerable radioprotective effect of the protamine adenosinetriphosphate (80% survival of the experimental animals in comparison with 2% of the controls). Protamine lowered considerably its toxicity when it was administered under the form of adenosinetriphosphate salt. (auth)

17455 DISTRIBUTION OF X-RAY INDUCED CHROMOSOMAL ABNORMALITIES IN KANGAROO RAT (POTOROUS TRIDACTYLIS) CELLS IN VITRO. van Steenis, H.; Tuscany, R.; Leigh, B. Mutat. Res.; 23: No. 2, 223-228(1974).

Synchronized fibroblastoid cells obtained from the heart tissue of a rat Kangaroo (2n = 12) were x-ray irradiated with 300 R in different phases of the cell cycle and chromosomal abnormalities were evaluated in the first post-irradiation metaphases. It was found that the distribution of breaks and gaps (achromatic lesions) along the arms of chromosomes differed and that it failed to correspond in both cases with random distribution. The relatively high frequency of chromosomal segments that displayed simultaneously a high or low sensitivity to the induction of breaks or gaps indicates that in some segments there exist differences in the effective size of the target. No clear-cut correlation was proved between the segments of different sensitivity and the specific bands on chromosomes (Giemsa banding). It appears that the non-random distribution of radiation-induced chromosomal abnormalities may be due to the different sensitivity to induced primary lesions as well as to the different efficiency of reparatory processes. (auth)

17456 ALLOGENEIC BONE MARROW CHIMERISM IN GERM-FREE MICE. Truitt, R. L.; Pollard, M. (Univ. of Notre Dame, IN). Weld. J. (N.Y.); 21: No. 1, 12-16(Jan 1976).

Hodgkin's-like reticulum cell sarcoma develops spontaneously in most SJL mice. Germ-free and conventional SJL mice bearing advanced reticulum cell sarcoma were treated with X-irradiation and transplantation of bone marrow from SJL or C3H/He donors. The 120-day survival rate of germ-free mice receiving allogeneic bone marrow (70 percent) exceeded that of all control groups; more importantly, germ-free mice that survived more than 4 months after treatment with allogeneic cells had no evidence of neoplastic lesions when killed. The germ-free environment effectively prevented graft-versus-host disease that was lethal to conventional mice. The results of these experiments offer additional evidence that bone marrow transplantation can be used as a therapeutic tool for spontaneous murine neoplasms. (auth)

17457 IRRADIATION STUDIES OF MALLARD DUCK EGGS MATERIAL CONTAINING MIREX. Lane, R. H.; Grodner, R. M.; Graves, J. L. (Louisiana State Univ., Baton Rouge). J. Agric. Food Chem.; 24: No. 1, 192-193(1976).

Eggs containing Mirex (dodecachloropentacyclo[5.3.0.0^{2,6}.0^{3,9}.0^{4,8}] decane) from mallard ducks (Anas platyrhychos l.), fed diets with the insecticide incorporated at levels of 1 and 100 ppM for 25 weeks, were subjected to ultraviolet (uv) and gamma irradiation. Seven derivatives were obtained on photolysis and eight derivatives were obtained from gamma irradiation. Irradiation products appeared to be mono and dihydro derivatives of Mirex. Structural assignments for two monohydro derivatives and three dihydro derivatives were made on the basis of retention time and mass spectral data. (auth)

17458 POST-IRRADIATION CHANGES IN OOCYTE POPULATIONS IN THE FRY OF THE FISH ORYZIAS LATIPES. Hamaguchi, S.; Egami, N. (Tokyo Univ.). Int. J. Radiat. Biol.; 28: No. 3, 279-284(Sep 1975).

Changes in the population of irradiated female germ cells of the fish, Oryzias latipes, (1000 R x rays, 50 R/min, 2,5 and 10 days after hatching) have been investigated in a study of the effects of x rays on germ cells at each stage of meiotic prophase. Some germ cells began to enter meiotic prophase at the time of hatching, and then went through the stages of meiotic prophase, i.e. leptotene, zygotene, pachytene and diplotene. Although the process was not always synchronized among the cells within an ovary, observations of changes in the oocyte population could be used to analyse the fate of germ cells at the various stages. The results demonstrated an obvious difference in sensitivity to x-irradiation between oocytes after diplotene and those before pachytene. When the germ cells were irradiated at diplotene, the cells were killed within 24 hours of irradiation. And, if oocytes in leptotene, zygotene, and pachytene were exposed to x rays, they could pass through the stages of meiotic prophase at a normal rate but then failed to enter into diplotene and degenerated. Some of the oogonia were killed immediately after the exposure but others underwent the normal developmental process and degenerated between pachytene and diplotene. The lesions in germ cells irradiated before pachytene therefore seem to be closely related to some process between pachytene and diplotene. The small number of germ cells which survived 15 to 20 days after x-irradiation (1000 R) probably developed from young oogonia present at the time of irradiation. (UK)

17459 RADIATION-INDUCED LIBERATION OF DNA-PROTEIN COMPLEX IN RAT SPLEEN. Kator, K. (Tokyo Univ.). Int. J. Radiat. Biol.; 28: No. 2, 199-204(Aug 1975).

It is shown that so-called "free DNA" released from irradiated rat spleen is in fact not free from nuclear proteins and is a DNA-protein complex. It is thought that it is a sort of deoxyribonucleoprotein and should therefore be called "free DNP". (UK)

17460 EVALUATION OF RADIOCHEMICAL PROTECTORS USING URINARY DEOXYCYTIDINE LEVELS. Wrede, D. E. (Univ. of Kentucky, Lexington); Chen, I. W.; Kereiakes, J. G.; Saenger, E. L. Int. J. Radiat. Biol.; 28: No. 2, 117-124(Aug 1975).

It is customary to use the LD_{50} response as a criterion for the evaluation of chemical radioprotection. The increased urinary excretion of deoxycytidine (CdR) in irradiated rats has been shown to be a linear dose-response relationship up to 200 R, thus making it possible to consider such a response as a criterion for chemical radioprotection evaluation at sub-lethal irradiation levels. Rats were subjected to 200 R x-irradiation with various chemical protectors and without chemical protectors, urine was collected 24 hours after irradiation, and the CdR levels in the urine analysed. A dose-reduction factor (DRF) was determined for 24-hour urinary excretions of CdR for chemically protected and non-protected rats. The DRF values are within 6 percent of those reported by other investigators using LD_{50} as the response criterion for serotonin, cysteine, MEA and PAPP but differ for WR-2721 and WR-2823. Agreement using WR-2721 and WR-2823 compounds is only obtained when the toxicity effect of the compound is taken into consideration. (auth)

17461 STUDIES ON DOMINANT LETHAL MUTATIONS IN THIRD GENERATION RATS REARED ON AN IRRADIATED DIET. Chauhan, P. S.; Aravindakshan, M.; Aiyar, A. S.; Sundaram, K. (Bhabha Atomic Research Centre, Bombay). Int. J. Radiat. Biol.; 28: No. 3, 215-223(Sep 1975).

Third generation male rats fed on gamma irradiated (0.2 Mrad and 2.5 Mrad) and unirradiated diets were studied in an attempt to detect induced mutagenic effects. Each rat was provided with two virgin females, and the females were replaced by a fresh pair after 1 week. Sequential mating was continued for 3 weeks; a further mating was carried out during the sixth week. The females were killed eleven days after the last day of caging, and their uterine contents examined for viable and dead (dead embryos and deciduomata) implants. Pre- and post-implantation lethalities were assessed and statistically evaluated. There were no systematic variations in pregnancy rates, either from week to week or between the groups. The total implants in animals given irradiated and unirradiated diets showed no systematic differences, although there was a reduced implantation rate in the second weekly mating of animals given the irradiated (0.2 Mrad) diet. No evidence of any induced mutagenicity could be found in assessments of preimplantation losses based on enumerations of corpora lutea and there was no increase in post-implantation lethality. These results therefore provide conclusive evidence of the lack of induction of dominant lethal mutations in the third generation of male rats fed on irradiated diets. (UK)

17462 FAILURE OF ANAEMIC STRESS TO EVOKE LEUKAEMIA IN X-IRRADIATED RATS. Myers, D. K. (Atomic Energy of Canada, Chalk River, Ont.). Int. J. Radiat. Biol.; 28: No. 2, 177-180(Aug 1975).

Experiments were carried out to determine whether repeated doses of irradiation would be more effective than a single dose in leukaemia induced by anaemic stress. It was found that extensive blood loss does not trigger the development of a high incidence of fatal leukaemias, nor was there any indication that a second exposure to a given dose of x-radiation would increase tumor incidence by more than double the effect of the first exposure to that particular dose. (UK)

17463 RENIN-ANGIOTENSIN AND ALDOSTERONE IN THE GASTRO-INTESTINAL SYNDROME AFTER WHOLE-BODY IRRADIATION. Gerber, G. B.; Gilliavod, N.; Deroo, J. (Centre d'Etude de l'Energie Nucleaire, Mol, Belgium). Int. J. Radiat. Biol.; 28: No. 3, 297-300(Sep 1975).

Exposure of rats to whole-body x-irradiation at doses of more than 1kR causes death 3 to 4 days later. The changes in renin and aldosterone intervening after supra-lethal and sub-lethal whole-body x-irradiation (2000 or 600 R, 250kV, 100R/min) have been investigated as possible factors in the gastro-intestinal syndrome. Renin in plasma was determined by radioimmunoassay of angiotensin I, and aldosterone was determined in plasma and urine. Renin activity in plasma increased slightly on day 2 after a supra-lethal exposure and reached very high levels on day 3, before death. After sub-lethal irradiation of 600R the increase was slight and not significant statistically. Aldosterone in plasma rose slightly during starvation and markedly after supra-lethal exposure from day 2 on until death. Aldosterone concentrations in urine (expressed in relation to creatinine excreted) were significantly higher on day 1 after exposures of both 600R and 2kR, and then declined temporarily, before reaching maximal values on day 3. Failure of renin-angiotensin and of aldosterone did not therefore occur after irradiation. Comparison with the times of onset of diarrhoea, alterations in blood pressure and the loss of sodium ions indicated that these changes were an expression of a shock system which developed gradually on days 1 to 2 after irradiation, reaching a climax on day 3 when the gastro-intestinal syndrome was fully developed. (UK)

17464 ALTERATIONS OF LIVER DNA AFTER X-IRRADIATION. Reassociation and Hybridization With Nuclear RNA. Tomura, T. (Univ. of California, Los Angeles); Van Lancker, J. L.; Ariyama, K. Int. J. Radiat. Biol.; 28: No. 3, 205-214 (Sep 1975).

When RNA was extracted either from irradiated or unirradiated rat livers, no difference in its ability to hybridize with DNA was detectable. In contrast, the ability of DNA extracted from irradiated animals to hybridize with RNA was decreased, probably as a result of DNA fragmentation. Sedimentation of x-irradiated DNA on sucrose gradients separated a small (low molecular weight) from a large peak (high molecular weight.). The hybridization capacity for RNA of the large molecular weight DNA was similar to that of unirradiated DNA, but that of the small molecular weight DNA was reduced. After irradiation of the denatured DNA in vitro, the reassociation of DNA was inhibited, which suggested that DNA strands had lost part of their complementariness. (auth)

17465 RADIOPROTECTIVE EFFECT OF CYTRIPHOS IN SHORT-TERM AND PROLONGED GAMMA IRRADIATION. Pantev, T.; Bokova, N.; Nikolov, I.; Rogozkin, V. D.; Sbitneva, M. F.; Chertkov, K. S. Acta Med. Bulg.; 2: No. 1, 50-57(1974).

Results are reported of a study of the radioprotective properties of the adenosinetriphosphate salt of cysteamine (cytriphos) in short-term and prolonged gamma irradiation. Acute cytriphos toxicity proved to be inferior to that of cysteamine hydrochloride. Administered in doses of 850 and 750 mg/kg prior to a brief exposure to γ rays it exerted a marked radioprotective effect on experimental animals. Distinct protective effect of Cytriphos was demonstrated both by the "survival rate" test and by data of other tests: bone marrow cell counts, number of endogenous splenic colonies and animal weight. In contrast to most radioprotective agents, the radioprotective effectiveness of Cytriphos

was preserved also in cases of long-term γ irradiation with doses of 10.7 and 3.75 R/min. Animal survival was by 38 to 45 percent higher than in control animals. The administration of Cytriphos after irradiation did not reduce the biologic effect of ionizing radiation, as measured by the afore-mentioned tests. (auth)

Invertebrates

17466 (COO-2001-12) GENETIC EFFECTS OF LOW X-RAY DOSES. Progress Report, September 16, 1974–September 30, 1975. Abrahamson, S.; Meyer, H. U. (Wisconsin Univ., Madison (USA)). Sep 1975. Contract E(11-1)-2001. 24p. Dep. NTIS $3.50.

Results are reported from large-scale experiments on the dose-kinetics of x-ray induced sex-linked lethal mutations in treated oogonia of Drosophila. (auth)

17467 (CRSSA-1973, pp 42-43) SPONTANEOUS ELECTRIC ACTIVITY OF SCORPION NERVOUS SYSTEM AND IRRADIATION BY IONIZING RADIATION. Goyffon, M.; Luyckx, J.; Drouet, J.; Court, L.; Vachon, M. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75-Paris (France)).

Disorders of motor behavior are observed in scorpions after a great whole-body irradiation. Scorpion nervous system shows a spontaneous rhythmic electric activity at different stages, central and peripheral. (FR)

17468 CAFFEINE TREATMENT OF THE MATERNAL REPAIR SYSTEM AND REPAIR OF CHROMOSOME BREAKS INDUCED IN DROSOPHILA SPERMATIDS. Sobels, F. H.; Mendelson, D. (State Univ., Leiden). Mutat. Res.; 28: No. 1, 133-136 (Apr 1975).

17469 MATHEMATICAL ANALYSIS OF THE MORTALITY KINETICS OF DROSOPHILA MELANOGASTER EXPOSED TO GAMMA RADIATION. Dolkas, C. B.; Atlan, H.; Dolkas, G.; Miquel, J. (Ames Research Center, Moffett Field, CA). Mech. Ageing Dev.; 4: 59-69(1975).

A mathematical model with nonlinear time-varying characteristics has been developed which describes the relationship between the kinetics of natural aging and radiation-induced delayed mortality. Based on this model, it appears that there is an immediate effect of radiation which is continuously, but nonlinearly, increasing in severity. Two phases appear in this variation, corresponding to the two phases (plateau and dying phase) of the mortality curves for control populations. Accordingly, S/E (survival time post-irradiation/further expectation of life) can best be interpreted as an increasing function during the plateau phase of normal mortality curves, which levels off during the ensuing dying phase. (auth)

17470 DISINFESTATION OF FRUIT FLIES IN MANGO BY GAMMA IRRADIATION. Thomas, P.; Rahalkar, G. W. (Bhabha Atomic Research Centre, Bombay). Curr. Sci. (India); 44: No. 21, 775-776(5 Nov 1975).

The present investigation was undertaken to ascertain the effect of gamma irradiation at dose levels normally employed for delaying the ripening process in mangoes on the prevention of emergence of adult fruit flies from infested fruits and to establish the radiosensitivity of fruit flies at different stages of their life cycle. Eggs, larvae, and pupae of two species of fruit flies were exposed to 0, 15, 25, 40, and 100 krad of gamma radiation at a dose rate of 75 krad/hour. The results of these preliminary studies show that a dose of 25 krad of gamma rays recommended for delaying the ripening of mangoes, can prevent the emergence of adults from fruit infested with the different developmental stages of oriental and melon fruit flies. (ERB)

Radionuclide Effects (Internal Source)

17471 (ORNL-5046, pp 219-220) PRACTICAL CONSIDERATION FOR COMPUTING THE DOSE TO THE BLADDER. Smith, E. M.; Warner, G. G. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

The various factors that will affect the radiation dose to the wall of the bladder of patients following the administration of radiopharmaceuticals labeled with ^{197}Hg or ^{203}Hg were evaluated. The factors studied included: total daily urine output; voiding schedule, volume of urine in the bladder at the time the radioactivity was administered, and stimulation of urine production. (CH)

Man

17472 (AED-CONF-74-725-000(Vol. 1), pp 124-146) PROBLEMS IN THE ASSESSMENT OF WHOLE-BODY EXPOSURE DUE TO INHALATION OF RADIONUCLIDES. Schieferdecker, H. 1974. (In German)

From annual meeting of the Fachverband fuer Strahlenschutz e.V. in cooperation with the Vereinigung Deutscher Strahlenschutzaerzte e.V.; Helgoland, F. R. Germany (23 Sep 1974).

8 figs.; 15 refs. Available from ZAED.

In radiation protection and environmental protection. Vol. 1. (Fachverband fuer Strahlenschutz e.V., Karlsruhe (F. R. Germany)).

The paper describes the usual methods of determination of the incorporation level of radionuclides. In direct measurements of the whole-body activity as well as with the indirect method of excretion analysis, the varying behavior of different chemical compounds of the radionuclides has to be borne in mind. The direct measurement of plutonium and other transuranium elements special problems owing to the fact that their soft X-ray radiation is strongly absorbed in the body, and special care must therefore be bestowed upon the calibration of the measurements. For the assessment of the whole-body exposure by urinalyses, the new ICRP lung model and Heaby's excretion function are referred to. In some cases, the data of the lung model enable conclusions on the whole-body exposure to be drawn from examination of the faeces if the conditions of inhalation are known. The practical use of this method and the problems involved are discussed by some examples. (DE)

17473 (ATS-TUH-1078) STATISTICAL ANALYSIS OF THE DIFFUSION OF POLLUTANTS AFTER EMISSIONS OF SEVERAL HOURS IN NORTHERN GERMANY. Schultz, H.; Voelz, E. (Technische Univ. Hannover (F. R. Germany). Arbeitsgruppe fuer Technischen Strahlenschutz). Apr 1975. 95p. (In German). (PNS-GfK-46/75). INIS

34 figs.; 11 tabs.; 13 refs. Available from ZAED.

At present it is possible to calculate the inhalation dose of a short-time emission by the Gaussian plume model and the dose of nearly continuous long-time emission over years by statistical methods. This paper describes a method to calculate the dose after an emission lasting a few hours up to one day under varying but real meteorological conditions in Northern Germany for regions up to about 10 to 20 km from the point of emission. For this purpose one could try to find characteristical sequences of weather for these times and then to calculate the inhalation dose for these sequences. Another method is to calculate the doses of short-time emissions following one another under the varying meteorological conditions and add them up to the time in concern. These resulting doses will be grouped according to the meteorological conditions such as Pasquill's turbulence types at the beginning of the emissions or according to the day time and will then be statistically analyzed. This leads to a forecast of the inhalation dose for these times of emission. (DE)

17474 (BNL-20767) MARSHALL ISLANDS RADIOLOGICAL FOLLOWUP. Greenhouse, N. A.; McCraw, T. F. (Brookhaven National Lab., Upton, N. Y. (USA)). [nd]. 6p. (CONF-760202-24). Dep. NTIS $3.50.

From 9th topical symposium on operational health physics; Denver, Colorado, USA (9 Feb 1976).

In August, 1968, President Johnson announced that the people of Bikini Atoll would be able to return to their homeland. Thereafter, similar approval was given for the return of the peoples of Enewetak. These two regions, which comprised the Pacific Nuclear Testing Areas from 1946 to 1958, will probably be repopulated by the original inhabitants and their families within the next year. As part of its continuing responsibility to insure the public health and safety in connection with the nuclear programs under its sponsorship, ERDA (formerly AEC) has contracted Brookhaven National Laboratory to establish radiological safety and environmental monitoring programs for the returning Bikini and Enewetak peoples. These programs are described in the following paper. They are designed to define the external radiation environment, assess radiation doses from internal emitters in the human food chain, make long range predictions of total doses and dose commitments to individuals and to each population group, and to suggest actions which will minimize doses via the more significant pathways. (auth)

17475 (ORNL-5046, pp 197-204) METABOLIC MODELS FOR ESTIMATION OF INTERNAL RADIATION EXPOSURE RECEIVED BY HUMAN SUBJECTS FROM THE INHALATION OF NOBLE GASES. Bernard, S. R.; Snyder, W. S. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Metabolic models needed for the estimation of radiation dose equivalents from exposure of human populations to atmospheric noble gases (^{133}Xe, ^{85}Kr, and ^{41}Ar) were developed. (CH)

17476 (ORNL-5046, pp 221) METABOLIC MODEL FOR WHOLE-BODY AND GASTROINTESTINAL-TRACT RETENTION OF ^{141}Ce IN A HUMAN INFANT. Bernard, S. R. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

A metabolic model for whole-body and gastrointestinal tract retention of ^{141}Ce in infant rats and dogs was extrapolated to a human infant. The radiation dose following a single intake of 1 mu Ci of ^{141}Ce nitrate was estimated. (CH)

17477 (ORNL-5046, pp 222-224) DOSIMETRY OF ^{241}Pu RECONSIDERED. Poston, J. W.; Snyder, W. S.; Owen, L. W. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Plutonium-241 is a pure beta emitter having a radioactive half-life of 13.2 years, a maximum energy of 20.8 keV, and an average energy of 5.2 keV[3]. Its range in tissue is about 8.2 mu m, which is far shorter than the range of most alpha particles. This has prompted us to consider carefully whether the dosimetry generally used for the alpha particles from ^{238}Pu or ^{239}Pu is appropriate for this beta emitter. The retention model used for alpha-emitting radionuclides of Pu, the standard ICRP lung model, and a particle size of 1 mu m average median aerodynamic diameter (AMAD) were used. An inhalation exposure of personnel to a class Y aerosol of pure ^{241}Pu and the dose over 50 years post-exposure for a single intake of this radionuclide were calculated. (CH)

17478 (ORNL-5046, pp 225-229) COMPUTER PROGRAM FOR ESTIMATING MICROCUIRE-DAYS OF A RADIONUCLIDE IN THE ORGANS OF THE HUMAN BODY. Snyder, W. S.; Ford, M. R.; Watson, S. B. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

A computer code was developed that embodies a system of differential equations to represent the transfer of activity in the body following radionuclide intake that assumes that retention can be adequately represented by a system of compartments with constant rates of transfer to other organs or out of the body. The ^{226}Ra chain was used as the test case. Integration of the equations for the chain of eight radionuclides for the time period of 50 years following intake or computer required execution time of only 9 sec. (CH)

17479 PEDIATRIC RADIOPHARMACEUTICAL DOSIMETRY. Kereiakes, J. G. (Cincinnati General Hospital); Saenger, E. L.; Sodd, V. J. (Excerpta Med. Int. Congr. Ser.; 2: 238-244(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Information on the various parameters involved in radionuclide dosimetry in pediatrics is presented. Radiation doses absorbed by children of various ages as a result of the administration of radiopharmaceuticals are presented. (NL)

17480 SURGICAL USE OF RADIOISOTOPES FOR THERAPEUTIC PURPOSES. Caldarola, L.; Badellino, F. (Istituto di Oncologia, Turin). Excerpta Med. Int. Congr. Ser.; 2: 294-295(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

17481 HUMAN CHROMOSOMAL ABERRATIONS INDUCED BY RADIOISOTOPES IN DIAGNOSTIC DOSES. Soler Ripoll, J. J.; Forteza Bover, G.; Belloch Zimmermann, V. (Univ., Valencia, Spain). pp 593-603 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A statistical analysis is given of chromosomal aberrations observed in man following diagnostic procedures with radionuclides and x-ray examinations. (NL)

17482 MEDICINAL THERAPY OF THYROTOXICOSIS WITH DUE CONSIDERATION OF PATHOGENETIC FORMS OF IODINE METABOLISM DISORDERS. Kotlyarov, E. V.; Budkevich, Yu. B. (Moscow Medical Inst.). Med. Radiol.; 16: No. 1, 18-22(Jan 1971). (In Russian).

The article sets forth the results of studies of the content of radioiodine in the thyroid gland, plasma protein, and tissues of 215 patients with toxic goiter. Eight groups of patients were singled out depending upon the combination of increase of iodine metabolism indices. The authors evolved a correlation between the effectiveness of treatment with iodine-containing organic thyrostatic agents and the features peculiar to disturbances of iodine metabolism. (auth)

Animals

17483 EFFECTS OF RADIATION ON FIELD RATS. Medina, I.F.S. (Philippine Atomic Energy Commission, Manila). Nucleus (Diliman, Quezon City); 13: No. 4, 11, 17-18(Mar 1975.

From 14th annual convention; Los Banos, Philippines (23 May 1975).

A review of the literature on experimental effects of radiation on germ cells of rats is presented. Adaptation of field rats to laboratory conditions is discussed. Experiments were conducted in which ^{32}P, tritiated thymidine, and tritiated uridine were administered to rats in drinking water. The following mutations were observed in the offspring of these rats: hairlessness, large head, satin-like fur, albinism, diminutive size, and eye cataracts. (HLW)

17484 EFFECT OF RADON INHALATION ON SOME OXIDATION-REDUCTION ENZYMES IN RAT ADRENALS. Robaczynski, J.; Kaplonska, J.; Lozinska, E. (Z Zakladu Histologii i Embriologii, Wroclaw). Pol. Tyg. Lek.; 29: No. 50, 2173-2176(16 Dec 1974). (In Polish).

Histochemical investigations were carried out on adrenals of white rats after radon inhalations from inhalers in Swieradow-spa. Increased reactions of oxido-reductive enzymes: NAD tetrazolium reductase, succinic dehydrogenase and glucose-6-phosphate dehydrogenase were observed in the adrenal cortex, particularly in the zona reticularis which was hypertrophied. Raised activity of oxido-reductive enzymes in the cells of adrenal cortex evidences increased metabolism in these cells which may reflect increased production of hormones. Finding of stimulation of adrenocortical cells after radon inhalations is of essential importance for explanation of the biological mechanism of action of radon used in balneotherapy. (auth)

17485 MORPHOLOGICAL EVALUATION OF ^{226}Ra INDUCED OSTEOGENIC SARCOMA IN MICE. Holusa, R.; Kofranek, V.; Onyskowova, Z. Neoplasma; 21: No. 6, 697-709(1974).

The authors describe the morphology of osteogenic sarcoma induced in mice by an intraperitoneal administration of Ra-226 in two dose levels (8.2 Ci/kg and 20 Ci/kg). In the strain of mice used only one spontaneous osteosarcoma was found. Non-osteogenic sarcomas in the exposed animals were distinguished by differential diagnostics. (auth)

17486 DEUTERIUM AND TRITIUM ISOTOPE EFFECTS ON THE MICROSOMAL N-DEMETHYLATION OF ETHYLMORPHINE. Thompson, J. A.; Holtzman, J. L. (Veterans Administration Hospital, Minneapolis). Drug Metab. Dispos.; 2: No. 6, 577-582 (1974).

Ethylmorphine (EM) and trideuteriomethylnorethylmorphine ($EM\text{-}CD_3$) were incubated with rat liver microsomes and an NADPH-generating system in parallel experiments. N-Demethylation was determined by measuring the formaldehyde formed. After 10 min at 37°C, the average deuterium isotope effect (k/sup H//k/sup D/) was 1.25. Similar small effects were found when incubations were terminated after 1, 2, 4, 8, and 16 min. The k/sup H//k/sup D/ did not vary when the incubations were buffered over the pH range from 5.6 to 8.4. Standard double-reciprocal plots of EM and $EM\text{-}CD_3$ concentration against the rate of formaldehyde formation yielded a V/sub max//sup H// V/sub max//sup D/ of 1.26 and identical K/sub M/ values of 0.21 mM. Oxygen uptake experiments in the presence of EM and $EM\text{-}CD_3$ demonstrated that deuterium substitution had no effect on this rate. A tritium isotope effect of 2.49 was calculated by incubating N-methyl-tritiated EM with microsomes, removing unreacted substrate from solution, and determining the distribution of tritium between water and formaldehyde. These data, together with that from previous experiments, demonstrate that the small isotope effects found with deuterated and tritiated EM are genuine rate effects and that two steps contribute significantly to the overall rate of N-demethylation. These are the cleavage of the C–H bond and the donation of a second electron to the proposed cytochrome P-450-substrate-superoxide complex. (auth)

Nuclide Kinetics and Toxicology

Man

Refer also to abstract 17476.

17487 (CEA-CR-3, pp 54-57) KINETICS OF THE BONE FIXATION OF TECHNETIUM PYROPHOSPHATE AND PRELIMINARY STUDY OF CALCITONIN CONTAINING TECHNETIUM.

Pasquier, J.; Paulin, R.; de Laforte, C.; Roux, F. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and Communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

In the context of research on the phosphorus metabolism it was decided to study the early bone fixation of technetium pyrophosphate and to prepare technetium-containing calcitonin in an attempt to quantify bone scintigraphy, to define kinetic parameters accounting for changes in the phosphocalcium metabolism and to obtain further information on bone-cartilage sites of the hypocalcemiant hormone. The results given sum up the preliminary tests. (FR)

17488 (CEA-CR-3, pp 118-121) USE OF SEQUENTIAL ACQUISITION OF SCINTILLATION CAMERA DATA FOR THE COMPARTMENTAL ANALYSIS OF RADIOIODIDE AND TECHNETIUM UPTAKE IN THE HUMAN THYROID. Tubiana, M.; Bazin, J. P.; Fragu, P.; Bok, B.; Moreau, R.; Di Paola, R. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and Communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

A system of on-line treatment of data from a scintillation camera was used to follow the radioactivity variation in normal and diseased human thyroids after injection of iodine 131 or technetium. The activity curves are recorded on magnetic tape for compartmental analysis on Univac 1106. This analysis was performed with either an overall model of early iodine metabolism or an essentially thyroid model. The arrival of iodide in the thyroid (expressed by the unidirectional clearance and the quantity of iodine in $\mu g \cdot min^{-1}$), the return of thyroid iodide to the plasma and the incorporation of thyroid iodide in the intrathyroid organic iodine pool were estimated. About twenty subjects were used for this study. (FR)

17489 (CRSSA-1973, pp 54-59) CALCULATIONS OF LOADS AND DOSES DELIVERED, FROM RADIOCHEMISTRY AND HUMAN SPECTROMETRY EXPERIMENTAL RESULTS IN A CASE OF INTERNAL CONTAMINATION IN MAN. (Validity of Morrow's Test and Retention Equations). Fatome, M.; Frossard, H.; Gueguen, J. P.; Prat, G.; Quentric, Y.; Rocquet, G. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75-Paris (France)).

The results of a previous study giving fecal and urinary excretion curves of five radioelements (cesium-137, cobalt-60, cerium-144, strontium-90, and plutonium-239) after radioactive aerosol inhalation by a man were interpreted. It is tried to draw conclusions on the validity of the theoretical parameters needed for calculating the load and the dose in man. (FR)

17490 (GSF-K-79) RADIATION PROTECTION MEASURES FOR THE HANDLING OF UNSEALED RADIOACTIVE MATERIALS. Moehrle, G. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). Mar 1975. 52p. (In German). INIS.

4 figs.; 23 refs.; with app.

The radiation protective medical measures are described which are required after contamination by radioactive materials or their incorporation. In the case of skin contamination, penetration by diffusion is explained and the maximum permissible value with regard to the various types of radiation is given. A detailed description of the decontamination measures including the necessary equipment follows. Indications for the treatment of injuries are given. In addition, incorporation due to inhalation, ingestion with intake through the skin are described, direct and indirect incorporation detection are explained, and the therapeutical possibilities and measures are gone into. (DE)

17491 (ORNL-5046, pp 230-232) SEMITHEORETICAL APPROACH TO EXCRETION AND RETENTION OF VARIOUS IONS. Henley, L. C. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Methods for the prediction of the urinary excretion rates of Pu and Am in man are described that are based on measured excretion rate of ^{90}Sr and ^{147}Pm. The influence of the properties of ions to form complexes is considered. It was assumed that the dielectric constant of the extracellular fluid in man and the absorption properties of his cellular tissue are constant and that Pu in man exists in only the tetrapositive state. (CH)

17492 MEASUREMENT OF THREE-HOUR CALCIUM ABSORPTION BY DOUBLE ISOTOPE TECHNIQUE: A CRITICAL EVALUATION. Raymakers, J. A.; Roelofs, J. M. M.; Duursma, S. A.; Visser, W. J. (State Univ., Utrecht). Neth. J. Med.; 18: No. 5, 191-204(1975).

The usefulness of the three-hour double isotope method for determining of calcium absorption is discussed on the basis of personal observations and of a critical discussion of the mathematics involved in evaluation of absorption kinetics. Distinction must be made between tests measuring absorption rate and those measuring total absorption of tracer; the former seem to give more reliable information on true dietary calcium absorption. Another distinction to be made is that between tests which assess some parameter of calcium absorption without simultaneous measurement of calcium losses from the body, and balance studies. The former are of value only to show changes in absorption in longitudinal studies but do not allow any conclusion as to the correctness of their adaptation to the needs of the individual. To discriminate between groups of patients, plasma radioactivity from oral tracer two hours after administration is as good as a three-hour absorption double isotope test, and there is a close correlation between these parameters. (NL)

17493 EVIDENCE OF INCREASED URANIUM CONTENT IN THE RED BLOOD CELLS OF URANIUM MINERS. Nosek, J.; Simkova, M.; Kukula, F.; Pehr, F.; Kubat, M. Prac. Lek.; 26: No. 4, 124-127(1974). (In Czech).

Neutron activation analysis was used to determine the uranium content in the dry matter of washed red blood cells from the venous blood of deep uranium miners. In controls (not exposed to uranium) an average 4.0 ± 2.5 ppb uranium was found in the dry matter of red blood cells, while in a group of uranium miners (exposed to uranium) the uranium content was much higher (11.3 to 42.0 ± 8.3 to 29.1 ppb). The increase of the uranium content is directly related to the number of years spent in mining profession. The data are analyzed statistically. (auth)

17494 DETERMINING CONTAMINATION OF URINE BY MEASURING BETA-RADIOACTIVITY WITH A CORRECTION TO ^{40}K. Holgye, Z.; Popper, J. Chem. Listy; 68: No. 11, 1177-1184 (1974). (In Czech).

A method is presented for a rapid estimation of internal contamination by measuring total beta-radioactivity with a correction to ^{40}K. The method is based on a determination of total beta-activity of the total solids of urine corrected to ^{40}K in a group of non-exposed persons. The mean and limit value was calculated which, with a probability of about 99%, is not exceeded by any member in the sample. Excession of this value was regarded as contamination. Lord's test was used in addition for an evidence of contamination. In different samples of non-exposed persons the determination sensitivity increased with the amount of urine analyzed, with the prolongation of measuring time, and with a parallel determination of the sample. (auth)

17495 PENETRATION INTO THE SKIN OF SURFACE-ACTIVE SUBSTANCES AND THEIR INFLUENCE ON SKIN RESORPTION OF CATIONS. Janeckova, V.; Fiker, S. Gig. Sanit.; No. 3, 87-88 (1974). (In Russian).

The effect of the surface-active sodium laurylsulphate on the skin resorption of cation Zn-65 proved to be statistically nonsignificant in experiments on human and hairless mice skin samples as well as in in vivo experiments on rats. The difference in skin resorption of Zn-65 was also statistically nonsignificant in in vivo experiments on hairless mice, however, there were statistically significant differences in the mean frequency of impulses in the skin itself between experimental and control groups in all experiments on hairless mice which indicates that due to the action of the sodium laurylsulphate tensid the penetration of Zn-65 into the skin is greater. There was also an increased penetration of As-74 into the skin under the effect of the named tensid with a maximum within 2 hrs of solution exposure on human and hairless mice skin samples in vitro. The amount of the tensid retained in the skin ranged from 4 to 30 $\mu g/cm^2$. (auth)

17496 PERSONNEL DOSIMETRY OF SHORT-LIVED RADON DAUGHTER PRODUCTS. Singer, J.; Trousil, J. Radioisotopy; 15: No. 3, 375-385(1974). (In Czech).

The authors tested a solid-state track detector permitting air aspiration and adsorption of decay products on a dielectric foil. The foil is measured after etching with a spark counter. The sensitivity of the detector ranges from 1 to 500 WL/hour. (auth)

Animals

17497 (CRSSA-1973, pp 52-54) RETENTION AND EXCRETION AFTER RADIOELEMENT INHALATION. Prat, G. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75-Paris (France)).

Metabolism, experimentally known from intravenous injections of radioelement chemical forms, is expressed by mathematical functions giving, in terms of time, numerical values of retained and excreted fractions of injected quantities. (FR)

17498 (CRSSA-1973, pp 91-92) EXTENDED TREATMENT OF RADIOCONTAMINATION WITH CESIUM 137 BY COLLOIDAL PRUSSIAN BLUE. Test on a Preparation Which Does Not Involve Hepatic Retention. Ducousso, R.; Causse, A. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75-Paris (France)).

Prussian blue, which is applied per os, is recommended in radiocontamination treatment with cesium-137. It has been tried to increase product efficiency in using dispersed forms, such as ferrocyanide-anion-ion exchanger resins or colloidal form. (FR)

17499 (CRSSA-1973, pp 93-94) COMPARATIVE EFFECTS OF ACETAZOLAMIDE AND PRUSSIAN BLUE ON CESIUM 137 RETENTION IN RAT. Ducousso, R.; Causse, A. [nd]. (In French)

In Centre de Recherches du Service de Sante des Armees. 1973 scientific works. (Centre de Recherches du Service de Sante des Armees, 75-Paris (France)).

Cesium retention in rat is described mathematically by addition of three exponentials. We have retained two classes of drugs for their efficiency in increasing cesium excretion. Acetazolamide increases the first two exponentials constants whereas Prussian Blue increases the third exponential constant without affecting the two others. (FR)

17500 INCREASED ^{144}Ce UPTAKE IN FETAL RATS AFTER THE ADDITION OF CARRIER. Mraz, F. R.; Eisele, G. R. (Comparative Animal Research Lab., Oak Ridge, TN). Radiat. Res.; 64: No. 2, 399-400(Nov 1975).

Rats on their 17th day of gestation were given ^{144}Ce intravenously, either carrier-free or with 143 mu g Ce. They were sacrificed 48 hr later, and the ^{144}Ce contents of their fetuses were determined. The fetuses from the dams that received cerium carrier contained 50 percent more ^{144}Ce than did those from dams that received no carrier. (auth)

17501 RETENTION OF A SINGLE DOSE OF MOLYBDENUM IN THE TISSUES OF EXPERIMENTAL ANIMALS. Bibr, B.; Lener, J. Physiol. Bohemoslov.; 23: No. 4, 341-342(1974).

The retention of molybdenum labelled ^{99}Mo applied to rats in a single dose of 20 to 1000 ng Mo/g body weight, is described. During two weeks after application the concentration of molybdenum was determined in parenteral organs, blood, skin and bone tissues. The biological clearance half life ranged from 2.5 to 6.9 days. In the skin, incisor and molar teeth a long-term retention of the element was observed. (auth)

17502 SIMILARITY OF ALKALINE EARTHS METABOLISM AND ^{67}Ga ACCUMULATION BY LIVER AS REVEALED BY ACUTE THIOACETAMIDE INTOXICATION. Anghileri, L. J. (Tumorforschung Klinikum, Essen). J. Nucl. Biol. Med.; 19: No. 3, 145-148(1975).

The distribution of ^{67}Ga, calcium, magnesium and phosphorus in liver of thioacetamide treated rats has been studied. ^{67}Ga appears to follow the entry of the alkaline earths into the liver cells and to adopt a fairly similar distribution pattern. A decreased ^{67}Ga and calcium binding by the lipoprotein fraction of blood serum and a change in the cell membrane semi-permeability (presumably due to a high turnover of the cell membrane phosphorus) appear to be the main effects of thioacetamide intoxication implicated in ^{67}Ga and alkaline earths accumulation. (auth)

17503 RADIOISOTOPE (^{99}Mo) STUDY OF THE KINETICS OF MOLYBDENUM CLEARANCE FROM THE BLOOD AND OF THE ROLE OF BLOOD COMPONENTS. Kselikova, M.; Bibr, B.; Lener, J. Physiol. Bohemoslov.; 23: No. 1, 83-88(1974).

The time and dose dependence of molybdenum content in blood and blood components was studied in young and adult rats after an intragastric and subcutaneous application of Mo-99. The dependence on the mode of application was determined only 1 hour after the application (the activity in blood, plasma and serum did not reach 1% of the original dose). A detailed electrophoretic study of the molybdenum bond to serum proteins showed that it was bound merely to the alpha-protein fraction. This finding was confirmed also by an autoradiography of electrophoregrams. (auth)

17504 RADIOTOXICITY OF INTRACELLULAR ^{67}Ga, ^{125}I, AND ^{3}H. Nuclear Versus Cytoplasmic Radiation Effects in Murine L1210 Leukaemia. Hofer, K. G.; Harris, C. R.; Smith, J. M. (Florida State Univ., Tallahassee). Int. J. Radiat. Biol.; 28: No. 3, 225-241(Sep 1975).

L1210 leukaemia cells were labelled with various doses of ^{67}Ga-citrate, ^{3}H-thymidine, or ^{125}I-iododeoxyuridine to evaluate the cytocidal effects of the intracellular decay of the three radionuclides. Based on radioisotope incorporation data, cellular dimensions, and intracellular radioisotope distributions (^{3}H and ^{125}I intranuclear, ^{67}Ga cytoplasmic) the rates of deposition of cellular, nuclear, and cytoplasmic energy were calculated. In terms of energy absorption/cell, ^{67}Ga (LD_{50}: 2250 keV/hr; 69 rad/hr) was much less toxic than either ^{3}H (LD_{50}: 325 keV/hr; 10 rad/hr) or ^{125}I(LD_{50}: 50 keV/hr; 1·5 rad/hr). In terms of energy absorption/nucleus, ^{67}Ga and ^{3}H produced almost identical effects (LD_{50}: 230 versus 255 keV/hr; 22·2 versus 24·6 rad/hr), but ^{125}I remained much more toxic (LD_{50}: 40 keV/hr; 3·9 rad/hr). These findings indicated that, although decay by electron capture in the cell nucleus (^{125}I) was highly destructive, the same type of decay occurring in the cytoplasm (^{67}Ga) was ineffective in killing L1210 cells. An analysis of the data suggested that the cytotoxic effects of the three radioisotopes resulted exclusively from nuclear damage. Cytoplasmic absorption of radiation energy appeared to contribute little, if anything, to the lethal effects of ionizing radiations. (auth)

17505 CHEMICAL FORMS OF TRITIUM IN REACTOR-PRODUCED FLUORINE-18. Collins, C. H.; Collins, K. E.; Ackerhalt, R. E.; Blau, M. (Roswell Park Memorial Inst., Buffalo). Int. J. Appl. Radiat. Isot.; 26: No. 10, 571-572(Oct 1975).

Radiopharmaceutical fluoride-^{18}F preparations from reactor-irradiated lithium carbonate are found to contain tritium in the forms of acetate-^{3}H, formate-^{3}H, and water-^{3}H. Most of the tritium activity from such fluorine-18 preparations clears from the serum of test rabbits with an effective half-life of ca. 3.5 days while the remainder (ca. 6%) clears with an effective half-life of about 3 weeks. (auth)

17506 EFFECTS OF DTPA ON THE DEPOSITION OF ^{65}Zn, ^{60}Co, AND ^{144}Ce IN PREGNANT RAT AND IN FOETOPLACENTAL UNIT. Zylicz, E.; Zablotna, R.; Geisler, J.; Szot, Z. (Inst. of Nuclear Research, Warsaw). Int. J. Radiat. Biol.; 28: No. 2, 125-136(Aug 1975).

Zinc-65, ^{60}Co, or ^{144}Ce was injected intravenously into rats at various stages of pregnancy. Six hours later, DTPA chelate of non-radioactive Ca, Zn, or Co was given intraperitoneally. Another group of pregnant rats received intravenous injection of ^{65}ZnDTPA or ^{60}CoDTPA. In both experiments, 24 hours after administration, the concentration of the radioactive material was determined in the dam's whole body as well as in foetuses, chorioallantoic placentae and yolk sacs. ^{65}Zn and ^{60}Co, which had been administered to the rats as DTPA complexes, were found not to pass from the dam's blood to the foetuses or to pass only in very minute amounts. This finding could be considered as an indirect indication that DTPA chelates do not penetrate the placental barrier. Nevertheless, the chelates injected intravenously into the dam early after an internal contamination, decrease the radionuclide content in the foetuses. No substantial effects of pregnancy on the effectiveness of the chelate in removing radionuclides from the body of rats were observed. (auth)

17507 EARLY PHASES OF THE KINETICS OF PLUTONIUM-239 METABOLISM IN THE CHIEF ORGANS AND TISSUES OF DEPOSITION IN THE ANIMAL ORGANISM. Nechev, H. Acta Med. Bulg.; 2: No. 1, 41-49(1974).

Albino rats received by single intravenous injection Plutonium-239 in the form of chloride with activity of 0.6 mcc. Investigations were carried out after 3 hours, 1, 3, and 6 days. Intravenously administered Plutonium-239 deposits mainly in the liver and bones. Peak radionuclide content in the liver (46.8 percent of the total amount in the organism) was recorded 3 hours after its administration; in the bones peak deposition (65 percent of the total amount) was measured on the 6th day. Plutonium-239 concentration however remained higher in the liver, where it appeared almost wholly bound with tissue proteins. In the bones it was bound with their organic and inorganic fractions (68 and 39 percent respectively). For the study period (6 days) the content of ^{239}Pu was reduced to half in the albumins and 1½ times in the globulins of the liver; the decrease in the ferritine, scleroproteins, and the sediment was 1.2 times. At the onset of the experiment the radionuclide was equally distributed in the collagen and the mineral fraction; later the collagen-bound portion was in-

creased. The content of ^{239}Pu in the albuminoids and other bone tissue proteins was essentially reduced. The effective period of radioisotope semielimination from the liver was exponentially determined and proved to be in the neighborhood of 10 days. It depends on the period of ^{239}Pu semielimination from the globulins. In the bones ^{239}Pu binding in complex compounds (mainly with collagen and the inorganic fraction) allows no decrease in the amount of radionuclide throughout the observation period (6 days). (Abstr. Bulg. Sci. Med. Lit.)

Plants

17508 ^{210}Po CONTENT IN TOBACCO AND TOBACCO PRODUCTS IN SLOVAKIA. Abel, E.; Sladkova, M.; Uralova, M.; Huszar, J. Cesk. Hyg.; 19: No. 10, 475-479(1974). (In Czech).

The content of ^{210}Po was studied in eight tobacco species grown or processed in Slovakia. The content of polonium was determined by using a modified method after Blanchard involving a combined electrochemical deposition on nickel and silver discs. The ^{210}Po activity was measured by a low background flow counter Biospan (Nuclear Chicago). The value of activities ranged between 0.19 to 1.05 $pCig^{-1}$ in dependence on the cumulative ability of individual tobacco species and on the class of quality (the I. class quality tobaccos showed the lowest values). The mean ^{210}Po activity in pipe tobaccos was 1.1 pCi/g, in cigarettes 0.43 pCi per cigarette. (auth)

17509 COBALT ACCUMULATION AND CIRCULATION BY BLACKGUM TREES. Thomas, W. A. (Oak Ridge National Lab., TN). Forest Sci; 21: No. 3, 222-226(Sep 1975).

Blackgum (Nyssa sylvatica Marsh.) trees accumulate far greater concentrations of cobalt in mature foliage than do other species on the same site (363 ppM in ash of blackgum, compared with about 3 ppM by mockernut hickory and about 1 ppM by red maple, tulip tree, and white oak). Cobalt concentrations in dormant woody tissues of blackgum also significantly exceed those in the other four species. Inoculation of six blackgums with ^{60}Co revealed that cobalt remains mobile in the trees for at least 3 years. Foliar concentrations of stable cobalt increase uniformly until senescence. In late August, foliage accounts for only 9 percent of total tree weight but 57 percent of total tree cobalt. Losses of cobalt from trees occur almost entirely by leaf abscission, and the loss rates of weight and cobalt from decomposing litter are similar. Retention of cobalt in the biologically active soil layers perpetuates zones of cobalt concentration created by this species in woodlands. (auth)

17510 EFFECT OF 2,4-DINITROPHENOL AND ATP ON UPTAKE, TRANSLOCATION AND DISTRIBUTION OF ^{32}P IN COTTON PLANTS UNDER DIFFERENT LIGHT CONDITIONS. Ashour, N. I.; Barakat, R.; Nour, T. A. (National Research Centre, Cairo). Curr. Sci. (India); 44: No. 23, 837-839(5 Dec 1975).

Cotton seedlings were subjected, in light and darkness, to DNP, ATP or both for 3 hours, then allowed to remain in contact with ^{32}P for further 6 hours. Darkness decreased phosphorus uptake and its translocation. In the light, DNP decreased the uptake of ^{32}P, but enhanced its translocation to the shoot. ATP did not affect ^{32}P uptake but enhanced its translocation. ATP could not overcome the negative effect of DNP on ^{32}P uptake. In the dark, neither DNP nor ATP exerted significant effect on ^{32}P uptake, yet accelerated its translocation. Under both light conditions, DNP accumulated most of the translocated ^{32}P in the stem, while ATP moved it further to the leaves. The enhancement of ^{32}P translocation was accompanied by the presence of higher percentage of ^{32}P in an organic form. It was concluded that high energy compound formed during photosynthesis may play a role in the metabolic active uptake of phosphorus. (auth)

17511 EFFECT OF SOIL PROPERTIES AND EXTRACTABLE LEAD LEVELS ON LEAD UPTAKE BY SOYBEANS. Miller, J. E.; Hassett, J. J.; Koeppe, D. E. (Univ. of Illinois, Urbana). Commun. Soil Sci. Plant Anal.; 6: No. 4, 339-347(1975).

Lead uptake by the above-ground portion of soybean plants was found to be inversely related to soil cation exchange capacity and pH, while available soil phosphorus levels did not influence lead uptake. Lead extracted from the soil with the Bray P_1 reagent was highly correlated with lead accumulation in both soybean and corn. Evidence is also presented that lead accummulation in soybeans is related to the degree to which the total sorptive capacity of the soil for Pb is satisfied. (auth)

17512 EFFECT OF SOIL LEAD SORPTION CAPACITY ON THE UPTAKE OF LEAD BY CORN. Miller, J. E.; Hassett, J. J.; Koeppe, D. E. (Univ. of Illinois, Urbana). Commun. Soil Sci. Plant Anal.; 6: No. 4, 349-358(1975).

Lead uptake by four-week-old corn shoots grown in Pb-amended soils was found to be dependent upon the level of Pb in the soil relative to the soil's capacity to sorb Pb. At a given level of added Pb, lead uptake by plants was found to decrease with an increase in soil pH, cation exchange capacity, and available phosphorus. (auth)

New Tracer Techniques

Refer also to abstracts 16593, 16698, 17205, 17216, 17471, 17487, and 17488.

17513 (AED-CONF-75-244-008) THE LEGAL ADMISSIBILITY OF EXPERIMENTS WITH RADIOACTIVE MEDICAMENTS INCLUDING RADIOACTIVELY LABELLED MEDICAMENTS. Pabel, H. (Bundesministerium fuer Jugend, Familie und Gesundheit, Bonn-Bad Godesberg (F. R. Germany)). 1975. 8p. (In German). INIS.

From 16th annual meeting of the Vereinigung Deutscher Strahlenschutzaerzte; Kiel, F. R. Germany (20 Jun 1975).

The testing of radioactively labelled drugs and radiopharmaceuticals with healthy test persons is studied by the author with regard to the present and future situation in radiation protection and drug legislation. After a discussion of the general regulations for the testing of drugs, the limitations stated by the 1st Radiation Protection Ordinance and the Atomic Energy Act are mentioned. In this connexion, the author states his concerns about the limitation to the use of ionizing radiation in human medicine as stated in the draft of the new Radiation Protection Ordinance. According to the present draft, the use of radioactive materials in research activities would be prohibited unless permitted by a special law. (DE)

17514 (CEA-CR-3, pp 1-50) DYNAMIC EXPLORATION OF THE CALCIUM METABOLISM. Milhaud, G. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and Communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

The principles and results of kinetic analysis which introduced the notion of turnover and dynamic equilibrium in research on the calcium metabolism are reported first. By the use of radioactive calcium it has enabled the chief parameters of this metabolism to be measured. Kinetic semiology of the calcium metabolism offers the possibility of both a determination of the disturbed process and a differential diagnosis of diseases affecting the bone, digestive tube and kidney. The kinetic characteristics of some disorders which were discovered, or their pathogenic mechanism explained by kinetic analysis are given by way of example. It is also shown that lesions affecting the skeleton can be localized and outlined by morphodynamic explorations using osteotropic indicators. Images of the skeleton should give a faithful picture of local changes in the bone metabolism but so far this is not the case because scintigraphy reveals only an increased metabolism without showing whether the final result will be an osteocondensation or a decalcification. It would be useful to find selective radioactive indicators of the various bone metabolism processes to which the scintigraphic documents could be interpreted in terms of bone metabolism. (FR)

17515 (CEA-CR-3, pp 51-53) MEASUREMENT OF REGIONAL CALCIUM ACCRETION IN PATIENTS TREATED FOR PAGET'S DISEASE AND IN PARAPLEGICS. Bergmann, P.; Schoutens, A.; Paternot, J.; Heilporn, E. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

The measurement of regional bone accretion of calcium has proved its worth in the study of two localized bone disorders, Paget's disease and the bone complications of medullar lesions. Intravenous injection of ^{47}Ca is followed during 6 days of external measurements with the human whole-body counter and daily determinations of the serum specific activity. Assuming that the decay slope of the extra-osseous activity is parallel to that which follows the serum activity between two and six days, the activity fixed on the skeleton is calculated by zones. The experiment covers 15 normal subjects, 10 patients with Paget's disease, 10 paraplegics and 28 cases of miscellaneous ailments. (FR)

17516 (CEA-CR-3, pp 58-61) MORPHODYNAMIC STUDY OF HAEMOPHILIC JOINT DISEASES WITH THE SCINTILLATION CAMERA AND A WHOLE-BODY SCINTIGRAPHY SYSTEM. Koutoulidis, C.; Papathanassiou, B. T.; Kambouroglou, G.; Louisou, C.; Mandalaki, T. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

Joint lesions in haemophilics were studied with a new whole-body scintigraphic system which combines the scintillation camera and an automatic travelling table. The results obtained are compared with clinical and radiographic data and an attempt is made to explain the mechanism of tracer uptake (^{99m}Tc-tin-pyrophosphate) on the lesions. This system is found to offer great advantages over traditional systems for the study of haemophilic joint diseases since all the joints affected can be estimated in a very short time, a very important point in following the progress of the lesion, preventing relapses, and checking the efficiency of the treatment. (FR)

17517 (CEA-CR-3, pp 62-65) DETECTION OF ASEPTIC OSTEONECROSES BY MEANS OF BONE SCINTIGRAPHY. Robert, J.; Naoun, A.; Gaucher, A.; Mabille, H. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

A record of osteonecrosis cases diagnosed on the basis of scintigraphic explorations since 1970 reveals 15 primary aseptic osteonecroses and 4 secondary aseptic osteonecroses of various origins. Secondary aseptic osteonecroses following cortisone treatment were discovered in 8 kidney transplants out of 29 explored. After the use of ^{87m}Sr and a scanning scintigraph, ^{99m}Tc labelled polyphosphates, pyrophosphates and diphosphonates were administered as soon as possible and scintigraphs taken with a cine-camera. For most patients the whole skeleton was scintigraphed, either by juxtaposition of the elementary scintigraph or camera images or, since the beginning of 1974, by means of an automatic travelling bed coupled to the camera. In these last cases the diseased regions were always scintigraphed individually to supplement the whole-skeleton picture. The results show the value of bone scintigraphy for early or even pre-radiological detection of aseptic osteonecroses. (FR)

17518 (CEA-CR-3, pp 66-69) SACRO-ILIAC SCINTIGRAPHY WITH TECHNETIUM PYROPHOSPHATE: ADVANTAGES AND LIMITS. Sulman, C.; d'Eshougues, R. J.; Delcambre, B.; Caillard, J. F.; Delbart, P. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

An attempt was made to determine whether scintigraphy, after administration of technetium 99m-labelled pyrophosphate, could be used to establish a relationship between the amount of fixation of the radioactive product and the degree of inflammation of the sacro-iliac joint in rheumatic sacro-iliac diseases. Given the difficulties of interpretation of these particular scintigraphs. normal limits were defined by establishing in standard subjects a numerical ratio between the sacro-iliac joints and a reference bone segment (lumbar rachis). The values obtained in 21 patients suffering from chronic inflammatory rheumatism show good agreement between the degree of technetium pyrophosphate fixation and the development of sacro-iliac diseases. (FR)

17519 (CEA-CR-3, pp 70-74) THE USE OF BONE SCINTIGRAPHY TO ESTABLISH CANCER EXTENSION RECORDS: APPLICATION TO PROSTATE AND BREAST CANCERS. Methlin, G.; Grob, J. C.; Moyses, B.; Dreschler, J. M.; Ott, G.; Berthelen, B. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

The recent development of the technique described, especially in the systematic search for metastases was due to the introduction of stannous diphosphate complexed with ^{99m}Tc well suited to bone scintigraphy. The documents are obtained in two stages. First a whole-body scintigraph is taken by means of an omniview device fitted to a Picker dynacamera, and this scanning phase is followed immediately by static views centered mainly on abnormal or doubtful regions. The results are given for 136 breast cancers and 61 prostate cancers, two cancers particularly liable to affect the bone, and show that scintigraphy offers positive advantages over radiological investigations. These advantages are offset to some extent by the non-specific nature of the hyperfixing regions since different diseases involving changes in the bone structure can give similar images, but for breast and prostate cancers bone scintigraphy presents distinct possibilities in the search for metastases of the skeleton. (FR)

17520 (CEA-CR-3, pp 75-77) SCINTIGRAPHIC SUPERVISION OF OSTEITIS. Manigault, L.; Sureau, B.; Wioland, M.; Perez, R. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

On the assumption that isotopic examinations of the bone metabolism and especially the scintigraphic method could give valuable results in the observation of osteitis patients treated with antibiotics, four cases of this disease were selected and followed regularly every three or four months for at least a year. Several bone scintigraphs were carried out with a scintillation camera after intravenous injection of technetium-labelled pyrophosphate and the hyperfixation variations of the osteitis center are given as a function of time. It is shown that bone scintigraphy gives an exact picture of the dimensions and morphology of lesions caused by an osteitis center and above all, if repeated, enables the development of the infected region to be estimated. It seems that the healing of osteitis can be judged from scintigraphic evidence. Scintigraphy may be considered as a means to check the efficiency of an antibiotic treatment. (FR)

17521 (CEA-CR-3, pp 104-107) LUNG VENTILATION IMAGE BY VISUALIZATION OF THE ^{133}Xe ELIMINATION COEFFICIENT. Mehier, H.; Mallet, J. J.; Veillas, G.; Cabocel, J. P.; Peyrin, J. O. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

A simple method is proposed for calculation of the ^{133}Xe elimination coefficient and its graphical representation giving a functional lung ventilation image, the advantages of the method are that it uses a small computing unit and above all involves only the start of the wash out phase, the only moment when xenon elimination belongs to a decreasing monoexponential time function. The validity of the method is illustrated by three typical results. (FR)

17522 (CEA-CR-3, pp 126-128) CORRECTION OF THE KINETIC BLUR AND REPRESENTATION OF HEART DYNAMICS IN NUCLEAR IMAGERY. Ignaszewski, A.; Vaillant, D.; Sabatier, J. P.; Fernandez, Y. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

In heart cavity studies the simplicity and harmlessness nuclear imagery are great advantages, but it is necessary to improve on the data obtainable by this technique. The usual image is faulty, owing to the presence of a kinetic softness, and deficient because it fails to account for the mobility of the walls. An attempt was made to correct the kinetic softness on an image and to reconstitute the film of a heart cycle, an aim achieved by combining a computer with the camera. The examination conditions generally adopted include storage of all data and a reconstitution of the entire cycle is programmed taking a multiple time unit of 20 ms; this supplies a sequence of images which when observed in succession resembles the heat contractility film. (FR)

17523 (CEA-CR-3, pp 129-132) FUNCTIONAL HEART STUDY BY MEANS OF THE SCINTILLATION CAMERA COMBINED WITH A DATA PROCESSING UNIT. Valeyre, J.; Morel, M.; Liehn, J. C.; de Vernejoul, P.; Fauchet, M.; Rimbert, J. N.; Spector, M.; Mestan, J. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

The scintillation camera is considered the ideal detector for functional heart studies because of its ability to grasp, at each instant, all the information contained in the zones of interest. This property allows sequential images to be established. The radiocardiographic plot from which certain parameters may be calculated is obtained from sequential cineangiocardiographic images. It is shown that the possibility of using data treatment units, with the successive operations programmed by the user himself has led to a genuine automation of the method, the aim being to achieve an objective determination of the zones of interest or characteristics points in place of a manual and subjective determination. (FR)

17524 (CEA-CR-3, pp 136-139) ANALYSIS OF SCINTILLATION γ CAMERA SIGNALS FOR DETERMINATION OF THE HEART-LUNG TRANSFER FUNCTION. Dumitresco, B.; Constantinesco, A.; Bonafous, J.; Healy, J. C.; Chambron, J. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

The idea was to use the transfer function of part of the circulation system to determine the distribution of tracer molecule transit times in this system. The results obtained for the transfer function in a theoretical case with recirculation and in an actual case were compared by using the signals from a γ camera. The study of this transfer function offers an approach, independently of tracer injection conditions, to the rheological flow parameters in the haemodynamic system considered. (FR)

17525 (CEA-CR-3, pp 140-144) DETERMINATION OF SEPARATE KIDNEY CLEARANCE BY MEANS OF THE Tc-DTPA COMPLEX AND THE SCINTILLATION CAMERA. Piepsz, A.; Dobbeleir, A.; Erbsmann, F. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

A new quantitative method to determine the separate kidney is described. This method is based on the use of the Tc-DTPA complex administered in a single intravenous injection, a scintillation camera and continuous computerized data recording for 20 minutes at 20 sec. intervals. By definition the slope of the kidney radioactivity curve, divided by the corresponding plasma concentration, represents at each instant the glomerular clearance of the kidney. This only applies before the 3rd minute following the intravenous tracer injection, when the filtered radioactivity has not yet left the kidney area. Between the 60th and 180th sec., 6 clearance values may be determined for each kidney. For each 20-sec. time interval the renal activity increase per minute is divided by the plasma concentration during the same interval and the average of these values is taken as the glomerular clearance figure. Some results have been analyzed. The test could end 3 min. after the intravenous injection. Continuation of the recording for 20 min. gives a complete dynamic picture of the kidney function. (FR)

17526 (CEA-CR-3, pp 145-151) ANALYSIS BY SATURATION. Milgrom, E.; Predine, J.; Saltarelli, D.; Pichon, M. F. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

Saturation analytical techniques are shown to have been developed originally in endocrinology but their field of application has since been considerably extended, especially in cancerology, pharmacology and haematology. To be applicable the method requires a binding system of adequate affinity and specificity (a property almost exclusive to proteins), a labelled ligand detectable at very low concentrations (in most cases this will be radioactive) and a non-labelled reference ligand. These different elements are studied. It is pointed out that saturation analysis allows compounds present in natural extracts to be determined at concentrations of a few tens of pg/ml or even less. (FR)

17527 (CEA-CR-3, pp 152-155) ^{75}Se-LABELLED CORTISOL IN ANALYSIS BY COMPETITION. Glover, J. S.; Chambers, V. E. M. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

Selenium 75 has nuclear properties very suitable for the labelling of steroids used as tracers in competition analysis. A method of preparing a selenium-labelled cortisol derivative, ^{75}Se methylselenoprednisolone, is described. A system based on bonding competition between plasma cortisol and ^{75}Se methylselenoprednisolone on transcortine was studied, the separation taking place on a Sephadex adsorbant. An early analysis with highly stable reagents was achieved. (FR)

17528 (CEA-CR-3, pp 156-158) USE OF IODINATED DERIVATIVES FOR RADIOIMMUNOLOGICAL DETERMINATION OF PROSTAGLANDINS. Macloud, J.; Renou, M.; Pradelles, P.; Dray, F.; Nehr, C. 1975. (In French).

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

In radioimmunological analysis using tritiated tracers the specific activity is limited for certain commercial products, prohibiting the determination of compounds such as PGE(I) 110Ci/mmole which has been found at a concentration below 2pg/ml in human peripheral plasma. An attempt was made to see whether this problem could be solved by the use of iodinated PG of much higher specific activity. The method employed is described, and shows a greatly improved sensitivity in the radioimmunological analysis of the PG tested owing to the use of an iodinated (iodine 125) tracer. In the case of PGE(I) for instance the sensitivity was increased by a factor 25. (FR)

17529 (CEA-CR-3, pp 159-161) USE OF AN IODINATED DERIVATIVE OF PENICILLIN FOR THE RADIOIMMUNOLOGICAL ANALYSIS OF PENICILLOYL GROUPS IN BIOLOGICAL MEDIA. Wal, J. M.; Bories, G.; Andrieu, J. M.; Dray, F. 1975. (In French)

From 17th French language symposium on nuclear medicine; Paris, France (2 Jun 1975).

In 17th French language symposium on nuclear medicine. Paris, June 2-4, 1975. Reports and communications. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Biologie).

A conjugate was obtained by covalent bond coupling of penicilloyl groups to bovine serum albumine (BSA) previously labelled with iodine 125. The reaction takes place in alkaline solution without intervention of carbodiimide. By its immunoreactivity and specific activity this conjugate is a suitable tracer in radioimmunology. The sensitivity and specificity of the determination were analyzed on standard curves. (FR)

17530 (COO-1231-104) METABOLISM OF ^{85}Sr AND OF OTHER ELEMENTS IN MAN, JULY 1, 1974-JUNE 30, 1975. (Veterans Administration Hospital, Hines, Ill. (USA)). 31 Dec 1975. Contract AT(11-1)-1231. 28p. Dep. NTIS $4.00.

Trace element studies have been carried out under strictly controlled dietary conditions in adult males during different calcium intakes. Complete metabolic balances of cadmium, copper, zinc, lead, manganese, and nickel were determined in each 6-day metabolic period by analyzing the constant diet and the urinary and fecal excretions of these naturally occurring elements. In addition to the trace element studies, ^{85}Sr studies were carried out in man in order to complete previously initiated investigations. (auth)

17531 RUBIDIUM MOBILITY IN THE APPLE-TREE AND AUTORADIOGRAPHY AS AN AID IN MEASURING THE DISTRIBUTION AND SPREAD OF THE ROOT-SYSTEM. Katana, H.; Kuehn, W. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Hanover). Newsletter on the Application of Nuclear Methods in Biology and Agriculture; No. 3, 18-27(Nov 1974).

Investigations were made on the usability of rubidium-86 for measuring the distribution and spread of the root system of fruit trees. The tracer techniques developed so far in horticulture are not applicable for various reasons. Therefore, a new method of autoradiography was developed. The results of the preliminary investigations are very promising. (NL)

17532 TIMING OF NITROGEN APPLICATION: ITS EFFECT ON NITROGEN UTILIZATION AND PROTEIN CONTENT OF RICE. Nagarajah, S.; Jauffer, M. M. M.; Willenberg, S. M. (Central Agricultural Research Inst., Peradeniya, Ceylon). Plant Soil; 42: No. 2, 349-358(Apr 1975).

Field experiments were conducted to determine the effect of the timing of nitrogen application on grain yield, nitrogen utilization, and protein content of rice. The treatments included single applications of 100 kg N/ha at planting, two weeks after planting, seven days before primordial initiation stage, flag leaf stage, and heading stage. Three methods of basal application and an application consisting of four equal split doses were also tested. 15N-labelled ammonium sulphate was applied to subplots to determine fertilizer-N uptake. Two varieties of rice Bg 11–11 (dry season) and Bg 34–8 (wet season) were grown. On the basis of grain yield on significant differences among the three methods of basal application were obtained. Fertilizer-N uptake data indicated placement of fertilizer in furrows at 5 cm depth to be the best method of basal application. On an average, the variety Bg 34–8 utilized more fertilizer N than variety Bg 11–11. Although nitrogen application at flag leaf and heading stages resulted in high fertilizer-N uptake they did not bring about substantial increases in grain yield; instead, the protein content of the grain was considerably increased. (NL)

17533 USE OF RADIOACTIVE PHOSPHORUS IN DETERMINING THE EFFICIENCY OF FERTILIZER UTILIZATION BY CACAO PLANTATION. Ahenkorah, Y. (Cocoa Research Inst., Tafo, Ghana). Plant Soil; 42: No. 2, 429-439(Apr 1975).

Both ^{32}P labeled phosphate solution and superphosphate were used in studying (1) in situ root distribution and activity of twenty year old Amelonado cacao (Theobroma Cacao L.) during wet and dry seasons, and (2) the efficiency of fertilizer utilization by the cacao plantation. The ^{32}P content of the leaves was used to determine patterns of root activity. Uptake of ^{32}P was greatest during the wet season and root activity highest within the upper 3 cm soil layer in both wet and dry seasons. Highest ^{32}P activity was obtained at a distance of 120–160 cm, and lowest at 91 cm from the base of the tree. For maximum utilization of phosphate fertilizer by a plantation of twenty year old Amelonado cacao, planted at 240 cm× 240 cm spacing, the fertilizer should be broadcast during the wet season. Under low soil moisture conditions, the placement of ^{32}P labeled superphosphate provides information on the relative availability of fertilizer or soil phosphorus and does not necessarily reflect the activity of the root profile. Active roots of cacao tend to be more extensive and are capable of exploring a much larger area than hitherto expected. (NL)

17534 EFFECTIVE RADIOIODINATION BY LACTOPEROXIDASE AND SOLUBILIZATION OF CELL-SURFACE PROTEINS OF CULTURED MURINE T LYMPHOMA CELLS. Haustein, D. (Walter and Eliza Hall Inst. of Medical Research, Parkville, Australia). J. Immunol. Methods; 7: No. 4, 25-38(Jul 1975).

Conditions for cell-surface radioiodination by lactoperoxidase developed previously for lymphocytes were found to be suboptimal for iodination of cells of different cultured mouse T lymphoma lines. The efficiency of iodination of these cells was greatly increased by adjusting the total iodide concentration to 20μm in the reaction mixture and reinitiating the enzyme-catalyzed reaction by repeated additions of lactoperoxidase and hydrogen peroxide at regular time intervals. By this procedure about 3 × 105 atoms of [^{125}I] iodide/lymphoma cell could be incorporated without loss of cell viability. Techniques for solubilization of radioiodinated cell-surface proteins of T lymphoma cells by metabolic release and by extraction with non-ionic detergent NP40, NP40-urea or urea-acetic acid were studied and compared. Only extraction with NP40-urea was sufficient to obtain 90–95% of cell-associated radioactivity in solution. Immunoglobulin was isolated and quantitated by specific coprecipitation from surface proteins of the cells of one lymphoma line (WEHI-22). It was found that the percentage of immunoglobulin in solubilized labeled cell-surface proteins was strongly dependent on the solubilization technique used. (NL)

17535 NON-SPECIFIC INTERFERENCE OF CERTAIN COMPONENTS OF TISSUE CULTURE MEDIA WITH THE RADIOIMMUNOASSAY OF RAT ALPHA-FOETOPROTEIN. Dambuyant, C.; Sizaret, P. (Centre International de Recherche sur le Cancer, Lyon). J. Immunol. Methods; 7: No. 1, 387-392(Apr 1975).

Interferences of "Williams" tissue culture medium used for cultivating rat hepatocytes upon rat alpha-foetoprotein (AFP) radioimmunoassay have been investigated. They are not due to foetal calf serum proteins which are added as growth factor and can be abolished by dialysis which appears to be necessary for the distinction between AFP non-producer and low-producer cell lines. Of the three major groups of non-mineral components examined, amino acid solution played a major role. When individual amino acids were examined using the double antibody technique, arginine was found to interfere predominantly; its dose-response curve was parallel to that of rat AFP which confirmed that an immunological identity between two substances cannot be established on the basis of parallelism as the only criterion. (NL)

17536 SIMPLE RADIOIMMUNOASSAY FOR THE ENUMERATION OF ROSETTE-FORMING CELLS. Teodorescu, M.; Mayer, E. P.; Dray, S. (Illinois Univ., Chicago). J. Immunol. Methods; 8: No. 1-2, 127-132(Aug 1975).

A simple radioimmunoassay for the enumeration of Ig bearing (Ig^+) lymphocytes by rosette formation with anti-Ig, antibody coated erythrocytes (Ab-E) is described. The method is based upon labeling lymphocyte populations with ^{51}Cr, rosetting them with Ab-E, separating the rosetted from the unrosetted cells in a rosetting system with unreactive uncoated-E. This permits the calculation of the percentage of rosette-forming Ig^+ cells. The assay eliminates the subjectivity and tediousness of counting and distinguishing between rosetted and unrosetted cells under the microscope. Being also sensitive and reliable, this radioimmunoassay may, after suitable modifications, replace the conventional counting of other types of rosettes. (NL)

17537 METHOD OF RADIOACTIVITY AND DENSITY LABELLING OF PLANT DNA. Ermisch, N.; Hemleben, V. (Univ. Tuebingen, Ger.). Newsletter on the Application of Nuclear Methods in Biology and Agriculture; No. 3, 7-8(Nov 1974).

17538 IMMUNOASSAY WITH LABELLED ANTIBODY. Jovanovic, B.; Lalic, R.; Cuperlovic, K. (Inst. for the Application of Nuclear Energy in Agriculture, Veterinary Medicine, and Forestry, Zemun, Yugoslavia). Newsletter on the Application of Nuclear Methods in Biology and Agriculture; No. 4, 4-6(May 1975).

17539 CLINICAL AND EXPERIMENTAL STUDIES OF TUMOUR-LOCALISING RADIONUCLIDES, WITH PARTICULAR REFERENCE TO ^{67}Ga-CITRATE. Paterson, A. H. G.; McCready, V. R.; Atkinson, K. (Royal Marsden Hospital, Sutton, Eng.). Excerpta Med. Int. Congr. Ser.; 2: 247-251(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Various factors determine the uptake of ^{67}Ga-citrate by tumors. Uptake by macrophages might be one of these factors. ^{67}Ga-citrate is clinically most useful as a tumor-localizing agent. (NL)

17540 ^{75}Se-SELENITE IN TUMOR DIAGNOSIS. Esteban, J.; Fombellida, J. C.; Vazquez, R.; Caballero, O. (Ciudad Sanitoria LaFE, Valencia). Excerpta Med. Int. Congr. Ser.; 2: 252-258 (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

^{75}Se-selenite is very useful as a tumor-localizing agent, especially for the visualization of malignant pulmonary processes and of primary hepatic tumors superimposed on cirrhotic liver. Because of its long half-life, the activity of ^{75}Se-selenite to be administered is limited. (NL)

17541 DETERMINATION OF RED CELL SURVIVAL BY ACTIVATION ANALYSIS. Uchiyama, G.; Akiba, K.; Kakehi, K. (Chiba Univ., Japan). Excerpta Med. Int. Congr. Ser.; 2: 308-313(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

The determination of red cell survival by activation analysis using enriched chromium-50 was applied clinically. The use of a lithium-drifted germanium detector avoids chemical separation of the samples after irradiation. Fairly good agreement was obtained between the half-lives determined by chromium-50-labelled red cells and those obtained with chromium-51-labelled red cells. (NL)

17542 MULTICRYSTAL SECTION IMAGING DEVICE AND ITS DATA PROCESSING. Tanaka, E.; Iinuma, T. A.; Nohara, N.; Tomitani, T.; Shimizu, T. (National Inst. of Radiological Sciences, Chiba, Japan). Excerpta Med. Int. Congr. Ser.; 2: 314-324(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A multicrystal-section imaging system suitable for brain scans has been constructed. High counting efficiency is combined with a spatial resolution of 13 mm at the center of the patient's head. The system is also applicable to scintigraphy of the liver. A one-dimensional convolution method has been developed for image reconstruction. The process involves a smoothing effect based on a Gaussian filter; the degree of smoothing is controlled by changing a parameter of the correction function. (NL)

17543 ADVANTAGES OF THE GAMMA CAMERA WITH A DATA-PROCESSING SYSTEM IN QUANTITATIVE RADIOCARDIOGRAPHY. Tarolo, G. L.; Spreafico, G. L. (Univ., Milan). Excerpta Med. Int. Congr. Ser.; 2: 325-328(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

The use of technetium-99m-pertechnetate and a gamma camera with a data-processing system enables separate determination of the left ventricular turnover time. The method is superior to conventional radiocardiography. (NL)

17544 TOMOGRAPHIC SCINTIGRAPHY WITH COMPUTERS. Crespo Diez, A.; Gonzalez, M.; Ortega, J.; Rodriguez, R.; Sampre, J.; Quesada, B.; Ramos, A.; Pascual, A.; Jodral, V. (Ciudad Sanitaria Virgen del Rocio, Seville). Excerpta Med. Int. Congr. Ser.; 2: 333-338(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A method is described to obtain transverse section images with conventional scanning instrumentation. An iterative data processing system is used obtaining images free from star patterns with high contrast and efficiency. The method gives accurate performance in single or multiple hot points which are perpendicular to the planes of the section coordinates, but produces false images when the distribution is diagonal. (NL)

17545 DESIDERATA OF NEW RADIOPHARMACEUTICALS. Cohen, Y.; Henry, R.; Hegesippe, M. (CEA-CEN de Saclay, Gif-sur-Yvette, France). Excerpta Med. Int. Congr. Ser.; 2: 358-362(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A review is given of the properties of recently introduced radiopharmaceuticals. Desiderata for new radiopharmaceuticals to be used either in radiotherapy or for diagnostic purposes are given. (NL)

17546 NEW ASPECTS IN THE PREPARATION OF ^{99m}Tc RADIOPHARMACEUTICALS. Ortega, J. L.; Crespo, A.; Lasa, D.; Martos, A.; Perez Modrego, S. (Ciudad Sanitaria Virgen del Rocio, Seville). Excerpta Med. Int. Congr. Ser.; 2: 363-365(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Methods are described for the preparation and analysis of ^{99m}Tc-albumin colloids and macroaggregates. (NL)

17547 PERCUTANEOUS HAM-SPLENOPORTOSCINTIGRAPHY, PORTA-SYSTEMIC SHUNTING AND HEPATIC SINUSOIDAL PRESSURE IN CIRRHOSIS OF THE LIVER. Weits, J.; Gips, C. H.; Niermeijer, P.; Beekhuis, H.; Piers, D. A.; Kruizinga, K. (State Univ., Groningen, Netherlands). Neth. J. Med.; 18: No. 5, 176-183(1975).

Splenoportoscintigraphy using ^{99m}Tc-human albumin microspheres, percutaneously injected into the spleen as a small bolus through a thin short needle was successfully performed in 36 out of 38 patients with cirrhosis of the liver. Pulmonary imaging indicating porta-systemic shunting was found in 17 patients. There was a positive correlation ($p = 0.02$) between pulmonary imaging and an abnormal rectal arterial ammonia test. Pulmonary imaging as well as delayed visualization of the liver were associated ($p = 0.001$ and $p < 0.01$ respectively) with a hepatic sinusoidal pressure greater or equal to 8 mm Hg (marked portal hypertension). Hepatic sinusoidal pressure increased spleen-lung interval ($r = 0.79$). (NL)

17548 INFLUENCE OF SALT, DEHYDRATION, AND OVERHYDRATION ON THE EXCRETION OF ARGININEVASOPRESSIN (AVP) IN URINE. van der Horn, M. J.; Schellekens, A. P. M.; Touber, J. L. (Amsterdam Univ.). Neth. J. Med.; 18: No. 5, 205(1975).

From 109th meeting of the Netherlands Society for Clinical Science; Utrecht, Netherlands (24 May 1975).

17549 ORPENADRINE (DISIPAL), SERUM THYROXINE AND THYROID FUNCTION. Wiersinga, W. M.; Fabius, A. J. M.; Touber, J. L. (Amsterdam Univ.). Neth. J. Med.; 18: No. 5, 205-206(1975).

From 109th meeting of the Netherlands Society for Clinical Science; Utrecht, Netherlands (24 May 1975).

17550 RADIOIMMUNOASSAY OF PENICILLOYL GROUPS IN BIOLOGICAL FLUIDS. Wal, J. M. (Institut National de Rechercher Agronomiques, Jouy-en-Josas, France); Mamas, S.; Dray, F. FEBS (Fed. Eur. Biochem. Soc.) Lett.; 57: No. 1, 9-13 (Sep 1975).

Penicilloyl-protein conjugates may be formed in man of animals after therapeutic treatment but cannot be detected by the classical microbiological assay methods used for penicillin. Allergies have been noted in consumers of products coming from animals treated with penicillin (milk particularly). Although these compounds present a risk to public health, they passed unnoticed through hygenic food inspection. Therefore a specific and sensitive method was devised for the assay of these derivatives in biological fluids where they can be present in trace amounts. An iodine-125 labelled conjugate has been prepared. Already usable for the detection of antipenicilloyl antibodies in sera of pencillin allergic patients, it has been used for the development of a radioimmunoassay of penicilloyl groups. Assay is done directly on milk, urine, and serum without previous extraction and with a detection limit of a few ppb. It permits a rapid, specific, and easy to handle determination in the sera of hospital patients as well as in the inspection of animal products at the slaughter house and at the dairy. (NL)

17551 ISOTOPE SCANNING OF THE CEREBROSPINAL FLUID PATHWAYS IN TUBERCULOUS MENINGITIS. Tandon, P. N.; Rao, M. A. P.; Banerji, A. K.; Pathak, S. N.; Dhar, J. (All India Inst. of Medical Sciences, New Delhi). J. Neurol. Sci.; 25: No. 4, 401-413(Aug 1975).

A prospective study for the introduction of a new isotope-scanning application is presented. Human serum albumin, labelled with iodine-131 is used for scanning the pathway of cerebrospinal fluid in patients suffering from tuberculous meningitis or its sequelae. The patients were observed for a period of three years. Case reports are given and the scanning results are discussed. (NL)

17552 LABELING KINETICS OF RNA CONTAINING POLY(A) IN LIVER SUBCELLULAR FRACTIONS. Hemminki, K. (Helsinki Univ.). Mol. Cell. Biochem.; 8: No. 2, 123-128(Aug 1975).

Kinetics of incorporation of (^{3}H) uridine into cytoplasmic RNA fractions of rat liver is investigated. The fractions include free and membrane-bound polysomes, rough membranes sedimenting with mitochondria and free cytoplasmic RNA particles. (1) Poly(A) containing RNA, isolated by oligo-dT cellulose, amounts to 0.4% of the total RNA in the homogenate, 0.5% in bound polysomes, 3.4% in free polysomes and 16% in free cytoplasmic RNA particles; (2) the rate of (^{3}H) uridine incorporation into RNA lacking poly(A) proceeds uniformly in all subcellular fractions except for free cytoplasmic RNA particles which accumulate negligible amounts of radioactivity; (3) the initial labelling of RNA containing poly(A) is most active in free cytoplasmic RNA particles supporting their identity as mRNA en route to polysomes. The initial specific radioactivities decrease in the following order: homogenate, bound polysomes, rough membranes sedimenting with mitochondria, free polysomes. The data suggest that mRNA is supplied to free and membrane-bound polysomes via different routes. The kinetic analysis indicates that free cytoplasmic RNA particles may be a precursor of mRNA of free polysomes rather than that of bound polysomes; (4) the kinetic differences of free and membrane-bound polysomes are also demonstrated by comparing the radioactivity of RNA containing poly(A) to the total radioactivity at various incorporation times. In bound polysomes this decreases from 31% at 1 h to 10% at 25 h, whereas in free polysomes the corresponding ratio increases from 10 to 13%. RNA containing poly(A) of free cytoplasmic RNA particles represents 64% of the total radioactivity throughout the experiment. (NL)

17553 APPLICATION OF ^{125}I-LABELLED SOLUBLE PROTEINS IN THE HISTOAUTORADIOGRAPHIC DETECTION OF ANTIGEN AND ANTIBODIES IN THE SPLEEN OF RABBITS DURING PRIMARY IMMUNE RESPONSE. Rodak, L. (Veterinary Research Inst., Brno). J. Immunol. Methods; 8: No. 4, 307-317 (Oct 1975).

An autoradiographic method for detecting soluble antigen (chicken, serum albumin, CSA) and specific antibodies in the spleen of rabbits during a primary immune response is described. The method consists of incubating sections from the spleen with ^{125}I-labelled IgG^2 anti CSA (for demonstration of antigen) or with ^{125}I-labelled antigen (for demonstration of specific antibodies). This treatment of histological sections combines the advantages and principles of the immunofluorescence technique with the possibility of evaluating the exact localization of the proteins by light microscopy in preparations stained with haematoxylin or methyl green-pyronin. The sensitivity of detection is very high: both antigen and antibodies could be demonstrated in the spleen follicles for as long as 42 days after the primary intravenous injection. (NL)

17554 SOLID PHASE MICRO-RADIOIMMUNOASSAY TO DETECT MINUTE AMOUNTS OF Ig CLASS SPECIFIC ANTI-VIRAL ANTIBODY IN A MOUSE MODEL SYSTEM. Charlton, D.; Blandford, G. (Univ. of Toronto). J. Immunol. Methods; 8: No. 4, 319-330(Oct 1975).

A simple and rapid micro-radioimmunoassay was developed to detect and quantitate class specific mouse anti-sendai virus antibodies. Two different ^{125}I-labelled indicator systems were studied. After incubation of test serum with antigen one system used ^{125}I-rabbit anti-mouse IgG (RIA 1) and the second employed

rabbit anti-mouse IgG, IgA or IgM followed by ^{125}I-sheep anti-rabbit immunoglobulin reagent (RIA 2). The RIA 2 method was adopted for routine use as it was more sensitive, gave better discrimination between sample and background counts and eliminated the need for several labelled rabbit anti-mouse Ig class specific antisera. The technique was found to be about 100 times more sensitive than conventional HI tests, specific, reliable and economical of reagents and time. (NL)

17555 QUANTITATIVE ESTIMATION OF CYTOTOXIC ACTIVITY OF IMMUNE LYMPHOCYTES USING ^{51}Cr-LABELLED PERITONEAL MACROPHAGES AS TARGET CELLS. Drizlikh, G. I.; Andre'ev, A. V.; Kotomina, I. P.; Brondz, B. D. (Inst. of Epidemiology and Microbiology, Moscow). J. Immunol. Methods; 8: No. 4, 383-393(Oct 1975).

Peritoneal macrophages labelled with ^{51}Cr in suspension cultivated for 48 hr on glass pretreated with poly-L-lysine were used as target cells for determination fo the cytotoxic effect of immune lymphocytes. ^{51}Cr release from such target cell from different strains of mice is 15.5 ± 0.8% of the total target cell radioactivity after 20 hr incubation with normal allogeneic lymphocytes. The use of 2% sodium dodecylsulphate ensures 100% solubilisation of labelled target cells growing on the glass surface and permits the cytotoxic effect to be determined by both ^{51}Cr release and measuring the label retained by the intact cells. The two methods proved to be accurate, reproducible and in accord with each other as well as with the method of direct cell counting. Determination of released ^{51}Cr enables the cytotoxic effect of lymphocytes to be measured after 4 hr incubation with the macrophage monolayer. SaI and Mc11 ascitic sarcomas display different sensitivities to the cytotoxic effect of immune lymphocytes and require different optimum conditions for its development. (NL)

17556 γ-TOMOGRAPHY. Schmidlin, P. (Deutsches Krebsforschungszentrum, Heidelberg). Excerpta Med. Int. Congr. Ser.; 2: 598-603(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Methods using Fourier transformations and those using iterative procedures in order to obtain tomographic images in scintigraphy are compared. (NL)

17557 PREPARATION OF ^{125}I-LABELED SECRETIN OF HIGH SPECIFIC RADIOACTIVITY. Tai, H. H.; Korsch, B.; Chey, W. Y. (Univ. of Rochester, NY). Anal. Biochem.; 69: No. 1, 34-42(Nov 1975).

A simple and rapid method of preparing ^{125}I-labeled secretin of high specific radioactivity has been developed. Synthetic porcine secretin was iodinated with Na[^{125}I] by a modification of the chloramine T method. Purification and separation of labeled from unlabeled secretin was achieved by chromatography on SP-Sephadex C-25 column. The labeled secretin possessed specific radioactivity as high as 500 to 550 mu Ci/mu g. (auth)

17558 LIQUID SCINTILLATION COUNTING OF CALCIUM-45 IN BIOLOGICAL MATERIAL. Blanusa, M. (Inst. for Medical Research, Zagreb). Anal. Biochem.; 69: No. 1, 120-130(Nov 1975).

Several scintillator solutions were tested for direct mixing with biological material for determination of calcium-45 radioactivity. For each system the capacity for aqueous solutions and stable calcium, the interference of various ions present in biological material, the stability of counting samples, and the possibility of quenching correction were determined. The results showed that the best capacity for aqueous acid solutions had Insta-Gel and Unisolve-1 scintillants. Triton-toluene-based scintillant showed marked unstability when mixed with biological fluids. The strongest quenching effect was produced by the yellow color of the ferric ion, which could be eliminated by complexing with the fluoride ion. For biological material of sufficiently high radioactivity the most convenient method seems to be counting the samples on filter paper in a toluene-based scintillator, especially since self-absorption in such a system can be corrected for by the channel and external standard ratio. (auth)

17559 NEW MARKERS IN LUNG SCANNING: IODINE-131 ALBUMIN MICROSPHERES, TECHNETIUM-99m ALBUMIN MICROSPHERES, INDIUM-113m ALBUMIN MICROSPHERES, INDIUM-113m IRON HYDROXIDE. Dziuk, E. Gruzlica Choroby Pluc; 43: No. 1, 13-20(Jan 1975). (In Polish).

One hundred and sixty scintigraphic examinations of the lungs were done with the use of: albumin microspheres labeled with iodine-131, technetium-99m, indium-113m, and macrocolloids of indium-113m iron hydroxide. After intravenous injection, the particles or microspheres remain in the pulmonary vascular bed, and their distribution depends on the blood flow. The recording of the isotope distribution in the lung was done by means of scintillation technique. Lung scans were performed in cases of suspected pulmonary thromboembolism, as well as in disturbances of vascularization in inflammatory processes, in emphysema, bronchiectasis, tumors, other pulmonary diseases, and in cases of pulmonary hypertension. Lung scanning is particularly useful in cases of suspected obstruction of the pulmonary artery. The examination is not cumbersome for the patient and it may be repeated several times. (auth)

17560 SCINTIGRAPHY OF THE JOINTS BY ^{99m}Tc. Bandilla, K.; Pfannenstiel, P.; Doepper, T. (Deutsche Klinik fuer Diagnostik, Wiesbaden). Verh. Dtsch. Ges. Rheumatol.; 3: 82-84 (1974). (In German).

One hundred patients with joint lesions were examined by means of the scintillation camera after intravenous injection of technetium-99m pertechnetate. In 60% of the cases with inflammatory joint diseases, the scan correlated very well with the clinical diagnosis; in few cases it was already positive with a still negative clinical diagnosis. In 40% with non-inflammatory joint diseases the correlation of clinical finding with the x-ray finding was better than with the scintigraphical finding, the latter one had most of the uncertain results. In 1% of all examined joints, the scintigraphical finding was positive in otherwise completely normal joints, particularly of the elbow and small foot joints. (auth)

17561 DIAGNOSIS OF INFLAMMATORY JOINT DISEASES BY SHORT-LIFE (^{113m}In, ^{87m}Sr) AND LUNG-LIFE (^{85}Sr) RADIONUCLIDES. Bull, U.; Schattenkirchner, M.; Frey, K. W.; Ghanatabadi, D. (Univ., Munich). Verh. Dtsch. Ges. Rheumatol.; 3: 86-88(1974). (In German).

In 50 patients with rheumatoid arthritis (RA) the accumulation of ^{87m}Sr, ^{113m}In, and partially also ^{85}Sr in the joints was measured by means of uptake measurements and scintigraphy. A significant differentiation of normal joints of 12 patients was possible in damaged hand, knee, and talo-calcanean joints, ankle joint, and talo-calcaneo-navicular joint with ^{87m}Sr and ^{85}Sr. While ^{85}Sr parameters showed better correlation with the roentgenological grades of the joint changes than ^{87m}Sr values the application of ^{113m}In allowed a differentiation of arthrosis-arthritis. The results of examinations with ^{87m}Sr in arthroses (n = 30) - before and after usual physiotherapy - furnished a good correlation with the clinical finding improvement; the level of ^{87m}Sr, however, decreased in RA with the duration of the disease. (auth)

17562 ACUTE SUBENDOCARDIAL MYOCARDIAL INFARCTION IN PATIENTS. Its Detection by Technetium 99m Stannous Pyrophosphate Myocardial Scintigrams. Willerson, J. T.; Parkey, R. W.; Bonte, F. J.; Meyer, S. L.; Stokely, E. M. (Univ. of Texas, Dallas). Circulation; 51: No. 3, 436-441(Mar 1975).

Eighty-eight patients admitted to a coronary care unit with chest pain of varying etiology but without ECG evidence of an acute transmural myocardial infarction had myocardial scintigrams using technetium-99m stannous pyrophosphate (/sup 99m/Tc-PYP). Seventeen of these patients had ECG and enzymatic evidence suggestive of acute subendocardial myocardial infarction. In each of these the scintigrams were positive demonstrating increased /sup 99m/Tc-PYP uptake either in a faintly but diffusely positive pattern or in a well-localized strongly positive one. The remaining 71 patients did not evolve ECG or enzymatic evidence of acute myocardial infarction. In each of these patients the myocardial scintigram was negative. Thus /sup 99m/Tc-PYP myocardial scintigrams are capable of identifying the presence of acute subendocardial myocardial infarction in patients. The absolute frequency with which subendocardial myocardial infarction can be recognized utilizing this technique will have to be established in a larger number of patients in the future. (auth)

17563 DIAGNOSTIC METHODS IN LIVER DISEASE. Black, M. (Temple Univ., Philadelphia). Med. Clin. North Am.; 59: No. 4, 1015-1023(Jul 1975).

At the present time the biochemical, serologic, and technological resources available in academic centers for the diagnosis of hepatic diseases are impressive. In that type of setting, and using the appropriate combination of diagnostic procedures discussed here, it is possible to determine with a considerable degree of accuracy the nature of the hepatic disease present, its extent, and, to a greater or lesser degree, its prognosis. Investigation in less favored centers must settle for diagnostic short-cuts and inevitably a lesser degree of accuracy. In either case, the state of the art is weighted heavily in favor of diagnosis and against successful therapy of most of the disease disclosed to be present. Radioisotope scanning, using ^{67}Ga, ^{198}Au, and ^{99}Tc, is discussed as a reliable method of diagnosis. (auth)

17564 GALLIUM-67 SCINTIGRAPHY OF PULMONARY DISEASES AS A COMPLEMENT TO RADIOGRAPHY. Siemsen, J. K.; Grebe, S. F.; Sargent, E. N.; Wentz, D. (Univ. of Southern California, Los Angeles). Radiology; 118: No. 2, 371-375(Feb 1976).

From 60th scientific assembly and annual meeting of the Radiological Society of North America; Chicago, IL, USA (1 Dec 1974).

Gallium chest scans of 575 patients were analyzed for their clinical usefulness in conjunction with chest radiographs. The series included patients with pulmonary carcinoma, lymphoma, tuberculosis, sarcoidosis, pneumoconiosis, and interstitial fibrosis. Gallium scintigraphy does not aid in the differential diagnosis of pulmonary diseases but is helpful in determining (a) the degree of activity of a known disease process; (b) treatment response, dosage, and duration; (c) the spatial extent of the disease; and (d) the presence of unsuspected disease foci hidden radiographically in the mediastinum, behind the heart, or in pleural or parenchymal scars. (auth)

17565 BILATERAL BREAST UPTAKE OF /sup 99m/Tc POLYPHOSPHATE IN A PATIENT WITH METASTATIC ADENOCARCINOMA. Shultz, M. M.; Morales, J. O.; Fishbein, P. G.; Steinberg, A. J. (Philadelphia General Hospital). Radiology; 118: No. 2, 377-378(Feb 1976).

Bilateral breast uptake of ^{99}/sup m/Tc-polyphosphate was found in a patient with metastatic adenocarcinoma from the rectum. The metastatic breast lesion showed no radiographic evidence of calcification. (auth)

17566 ANALYSIS OF THE RADIOIMMUNOASSAY FOR GONADOTROPIN-RELEASING HORMONE (GnRH): STUDIES ON THE EFFECT OF RADIOIODINATED GnRH. Clemens, L. E.; Kelch, R. P.; Markovs, M.; Westhoff, M. H.; Dermody, W. C. (Univ. of Michigan, Ann Arbor). J. Clin. Endocrinol. Metab.; 41: No. 6, 1058-1064(Dec 1975).

When GnRH is radioiodinated by the chloramine-T method, two immunoreactive labeled species are formed at pH 6.5 with a chloramine-T:GnRH molar ratio of 11:1, whereas four bands (I, IIa, IIb, and III) are separated by polyacrylamide gel electrophoresis when the hormone is iodinated at pH 7.5 in a system containing a 97:1 molar ratio of chloramine-T:GnRH. Because they were more stable and were more immunoreactive than the other products, band I and band IIa from the latter system were used separately as tracers with Niswender antiserum R-42 in radioimmunoassays for GnRH. The standard curves of each tracer are distinct: when analyzed after log-logit transformation, the band I curve had a mean slope of -3.31 ± 0.2 (SE) and a 50 percent B/B/sub T/ level of 9 ± 0.8 pg (n equals 8) of synthetic GnRH, whereas the band IIa standard curve had a slope of -2.30 ± 0.6 and a 50 percent B/B/sub T/ value of 20 ± 0.9 pg (n equals 11). As measured in the band IIa assay, hypothalamic extracts from control adult male rats contained 3.1 ± 0.4 ng while hypothalami from castrated rats contained 1.4 ± 0.1 ng. Similar but slightly lower values were obtained with band I. In contrast, the GnRH content of pineal glands from intact and castrated male rats was similar (approximately 150 pg) when determined in either assay. These studies emphasize that: the characteristics of the radioiodinated hormone can influence the quantitation of GnRH; and endogenous plasma concentrations of GnRH are much lower than previously reported. (auth)

17567 RADIOASSAY FOR SERUM AND RED CELL FOLATE. Longo, D. L.; Herbert, V. (Bronx Veterans Administration Hospital, NY). J. Lab. Clin. Med.; 87: No. 1, 138-151(Jan 1976).

A simple, reliable assay for serum and red cell folate is described. It uses plain untreated liquid or powdered milk, requiring no special handling or purification, as binder. Such milk makes it possible to ignore endogenous serum folate binder, since crude (but not purified) milk contains a factor which releases folate from serum binder. It simplifies counting radioactivity by employing a gamma emitting isotope of pteroylglutamic acid (PGA), namely the ^{125}I-tyramide of PGA. Like the ^{3}H-PGA assay of Givas and Gutcho, it permits the use of stable PGA rather than unstable methyltetrahydrofolic acid (MeTHFA) standards, because it is carried out at pH 9.3, a pH at which milk folate binder is unable to distinguish PGA from MeTHFA, which is the predominant folate in human tissues. The equipment required to do the radioassay is present in most diagnostic chemistry laboratories. Results are essentially identical to the generally accepted Lactobacillus casei microbiologic method of folate assay, except that false low results are not produced in the radioassay by antibiotics, tranquilizers, and chemotherapeutic agents. Three caveats in its use are the relative instability of ^{125}I-PGA as compared to ^{3}H-PGA, the fact that various powdered milks differ widely in folate-binding capacity, and that only about 60 percent of commercially obtained skim or powdered milk preparations appear to contain the substance which splits folate from serum binder. (auth)

17568 SATISFACTORY RADIOIODINATION OF RABBIT FIBRINOGEN USING CHLORAMINE-T. Moza, A. K.; Kumar, M.; Sapru, R. P. (Postgraduate Inst. of Medical Education and Research,Chandigarh,India). J. Lab. Clin. Med.; 87: No. 1, 169-178(Jan 1976).

A method for radioiodination of fibrinogen using chloramine-T is described. Samples of greater than 90 percent clottable counts were obtained. Electrophoretic mobility and immunodiffusion showed that the entire radioactivity was present in the fibrinogen band. In vivo studies on the turnover of this labeled product in rabbits showed a half-life of 52.8 to 61.7 hours in two batches of animals. The results compare very well with the reported results obtained from fibrinogen labeled with radioactive iodine by the iodine-monochloride method. The advantages of the new method are indicated. (auth)

17569 DISTRIBUTION AND BIOLOGICAL HALF-TIME OF ^{203}Hg IN THE HUMAN BODY ACCORDING TO A MODIFIED WHOLE-BODY COUNTING TECHNIQUE. Hattula, T.; Rahola, T. (Univ. of Helsinki). Environ. Physiol. Biochem.; 5: No. 4, 252-257(1975).

The distribution and biological half-life of ^{203}Hg in the human body was investigated using ^{203}Hg-labeled compounds and a regional whole-body counting technique. Fifteen volunteers were administered methylmercury as a labeled fish proteinate. A single serving of the proteinate contained an average of 1.8 μCi of ^{203}Hg-activity and 22 μg of total mercury. Inorganic mercury was given to eight volunteers as labeled calf liver paste containing $4 - 8$ μCi of inorganic ^{203}Hg-activity and 6 μg of total mercury. The radiomercury determinations were performed in a steel room equipped with the standard chair geometry and one 4" × 8" NaI(Tl) crystal. For determinations of ^{203}Hg-activity in the head a 3" × 3" NaI(Tl) crystal was used. A lead collar was utilized as a shield in order to absorb any disturbing radiation that might originate in the stomach region. The effectiveness of the Pb collar was determined using phantoms. The activities in the whole-body, the head, the legs and the liver were determined. About 20% of the methylmercury activity in the whole-body was found to be localized in the head 30 d after administration. No significant amounts of ^{203}Hg-activity were found in the head during the first 58 d after administration of inorganic mercury. An average value of $10 - 15$% methylmercury activity was found in the legs 30 d after administration. A control mean value of 13% was determined by measuring five of the same volunteers the next day in Sweden. Not more than 1% of inorganic mercury was found in leg muscle after 39 d in one male volunteer. The biological half-life of protein-bound inorganic mercury in the liver region, studied in one male volunteer, was estimated at 53 ± 15 d. (auth)

17570 ANGIOSCINTIGRAPHY OF THE MYOCARDIUM IN CHRONIC ANGINA PECTORIS. Heeger, H.; Aldor, E.; Kahn, P. (Hanusch-Krankenhauses, Vienna). Z. Kardiol.; 62: No. 11, 998-1004(Nov 1973). (In German).

The angioscintigraphy of the myocardium enables a clinical assessment of the myocardial microcirculation. In photoscans, scars due to myocardial infarctions are identified by a missing of blackening, which makes possible an assessment of the size of these scars. On the other hand patients with chronic angina pectoris, who had not suffered myocardial infarction, show disseminated fixation defects in the angioscintigram. In agreement with the investigation of Poche, we believe these fixation defects are caused by scintigraphic demonstrated vascular occlusions in the microcirculation, which are the cause of disseminated, hypoxidotic muscle necrosis. So the angioscintigraphy of the myocardium gives a better understanding of the genesis of these ischaemic lesions and a more exact indication for therapeutic procedures. (auth)

17571 RESULTS OF A COMPARATIVE STUDY ON INSULIN RADIOIMMUNOASSAY IN 36 ITALIAN LABORATORIES. Costantini, A.; Lostia, O.; Malvano, R.; Rolleri, E.; Taggi, F.; Zucchelli, G. C. (Consiglio Nazionale delle Ricerche, Pisa, Italy). J. Nucl. Biol. Med.; 19: No. 3, 164-176(1975).

An interlaboratory study in which the insulin contents of five plasma samples were estimated in 36 Italian laboratories was coordinated by the Istituto Superiore di Sanità (National Institute of Health) and the Consiglio Nazionale delle Ricerche (National Research Council). A rather large between-laboratory variability resulted, though the ranking of samples according to their insulin concentrations was practically the same. A significant dependence of estimates on the method used was established. The analysis of data, aimed at defining the possible reasons of the assay variability, is reported and discussed. (auth)

17572 HEPATIC SCINTIGRAPHIC DEFECT IN VIRAL HEPATITIS. Bergmann, P.; Struyven, J.; Somers, G. (Univ. of Brussels). J. Nucl. Biol. Med.; 19: No. 3, 162-163(1975).

A case of viral hepatitis with large focal defect on ^{99m}Tc colloid liver scintigraphy is reported. The appearance returned to normal within 4 weeks. The presence of a defect in viral hepatitis represents a possible pitfall in the interpretation of liver scintigraphy. (auth)

17573 COMPARISON OF IN VITRO METHODS IN THE ASSESSMENT OF THYROID STATUS. Gimlette, T. M. D.; Piffanelli, A.; Squire, C. R.; Brocchi, A. (Liverpool Clinic). J. Nucl. Biol. Med.; 19: No. 3, 155-161(1975).

The assessment of thyroid status by in vitro methods is compared in 334 patients; 168 were previously untreated, 90 had been treated with ^{131}I, 41 were clinically euthyroid on thyroxine replacement, 15 pregnant, 9 taking oral contraceptives and 11 taking neomercazole. The methods used were Serum Thyroxine by the Murphy method and by radioimmunoassay (Dow–Lepetit) and Serum Triiodothyronine by two radioimmunoassays (Dow–Lepetit and R. C. C. Amersham). A triiodothyronine uptake test using Sephadex column chromatography was used to obtain Free Thyroxine and Triiodothyronine Indices. T_4/T_3 ratios were calculated. Additional studies were used where necessary to establish the diagnosis. Overall the most accurate assay in diagnosis was the T_3 radioimmunoassay (R. C. C. Amersham), particularly in the hyperthyroid and the neomercazole treated patients, marginally improved by using the Free Triiodothronine Index. In thyroxine treated patients the triiodothyronine assays were more accurate than thyroxine assays which tended to give high values. In pregnancy thyroxine radioimmunoassay (Dow–Lepetit) and the two indices were the most accurate. T_4/T_3 ratios were significantly different from normal in hyper-, hypothyroid and thyroxine treated patients but the results were of little diagnostic value. (auth)

17574 FOCAL AND GENERALIZED HEPATIC LESIONS: A COMPARISON OF LIVER SCANS WITH ANATOMIC AND HISTOLOGIC FINDINGS. Ferlin, G. (General Hospital, Castelfranco Veneto, Italy). J. Nucl. Biol. Med.; 19: No. 3, 135-144(1975).

From 14th national congress of the Italian Society of Nuclear Biology and Medicine; Padova, Italy (2 Nov 1974).

More than 1,000 scintiphotographic studies of liver have been performed during three years (1971-1973) at the General Hospital of Belluno. In 178 cases (28 normal patients and 150 with liver diseases), the author has compared the results of scintiphotography with histologic and anatomic findings obtained from laparotomy with biopsy (111 cases), percutaneous needle-biopsy (15 cases), surgery and necropsy (52 cases). Liver images, obtained using ^{99m}Tc-sulphur colloid and scanner or Anger camera, were evaluated following criteria described in former notes. Two groups of images, one characterized by cold areas only (51 cases), and the other by generalized abnormalities and variable degrees of spleen and bone marrow uptake (74 cases), agreed with anatomic and histologic findings respectively in 45 (90%) and 71 (96%) cases. 22 liver studies, showing generalized abnormalities with intense extrahepatic reticuloendothelial system uptake and focal lesions, have been included in a third group: in 9 of these cases (46%) there was, at histology, association of cirrhosis and cancer. In 31 patients the images were normal: 21 had no liver disease (67%), 3 had metastatic lesions and 7 had fatty liver. Scintiphotography was abnormal in 93% of liver diseases (140 cases). In 146 cases (82%) there was complete agreement with anatomical and histological findings; disagreement was found in 32 cases (18%). (auth)

17575 UTILIZATION OF THE RADIONUCLIDE CARDIAC ANGIOGRAM FOR DETERMINATION OF CARDIAC OUTPUT AND EJECTION FRACTION. Alazraki, N. P.; Schelbert, H. R.; Verba, J. W.; Brock, G. W.; Johnson, A. D.; Ashburn, W. L. (Veterans Administration Hospital, San Diego, CA). J. Nucl. Biol. Med.; 19: No. 3, 127-134(1975).

From 7th world congress of cardiology; Buenos Aires, Argentina (Sep 1974).

Radionuclide cardiac angiograms were performed on 20 patients, and the ejection fraction and the cardiac output were calculated by a computer-aided data processing technique. This included: selection of a region of interest over the left ventricular blood pool on the computer oscilloscope; generation of the corresponding time-activity curve; correction for noncardiac background based on an open perimeter region of interest around the left ventricle; sine wave fitting of the peak-valley fluctuations of the left ventricular time-activity curve; gamma variate curve fitting of the histogram of the initial passage of the bolus for analytical computation of area under curve. In addition to radionuclide cardiac angiography, all 20 patients had standard measurements of cardiac output by the idiocyanine green dye method, and of ejection fraction by biplane cineventriculography. The results showed that radionuclide cardiac output determinations correlated well (correlation coefficient = 0.95) with those of green dye dilution method. Similarly, radionuclide determinations of ejection fractions were in good agreement (correlation coefficient = 0.94) with those obtained from biplane cineventriculography. The effects of the site and size of the background region of interest on determination of the ejection fractions were also examined. The reproducibility of the radiocardiographic method was tested by independent use of the computer program by three operators. It was concluded that radionuclide cardiac angiography is a reproducible method for accurate estimation of cardiac output and ejection fraction; its non-invasiveness makes it suitable for use in outpatients as well as in acutely ill patients. (auth)

17576 EXPERIMENTAL STUDY OF THE DISTRIBUTION OF TERRILYTIN-^{125}I IN THE ORGANISM. Andreev, S. V.; Kasatkin, Yu. N.; Kubatiev, A. A.; Yurkiv, V. A.; Masenko, V. P.; Krotkov, F. F. (Inst. of Morphological Ages, Moscow). Dokl. Akad. Nauk SSSR; 223: No. 3, 748-750(21 Jul 1975). (In Russian)

A proteolytic enzyme separated from the mushroom culture liquid of Aspergillus terricolae has been shown to possess lytic properties in the dissolution of thrombi in animals. This substance called terrilytin was tagged with ^{125}I and ^{131}I by using chloramine T and iodine monochloride as oxidizing agents. The tagged terrilytin was purified from slats and degradation products by the use of gel-filtration (Sephadex G-75). Thromboses of the jugular vein were created in 5 dogs, and a dose of 3 microcuries of terrilytin-^{125}I per kg body weight and 20 microcuries of terrilytin-^{131}I per kg body weight was administered intravenously to the dogs one day after creation of the thrombosis. The carrier dose (untagged terrilytin) was 10 mg per 1 kg body weight. Four dogs were used as controls. Samples of urine, feces and bile were taken. The dogs were killed 6 and 72 hours after administering the tagged terrilytin, and the distribution of terrilytin-^{125}I in various organs and tissues of the body was determined. Six hours after start of the experiment, radioactivity was found in all organs except the brain with maximum accumulation in the thyroid. High levels were found in the heart, lungs, kidneys and liver. The thrombus itself showed a comparable level of activity. The distribution of radiotracer in various parts of the thrombus was homogeneous. The high concentration of terrilytin in the heart and lungs, along with its active inclusion in the thrombus, would point to its further use in clinical practice for the treatment of thromboses of coronary and pulmonary vessels. (SJR)

17577 RADIOTRACER STUDY OF THE SENSITIVITY OF BACTERIA TO ANTIBIOTICS. J. Nagy, E. (MTA Orvos-Radiological Akademiai Tanszeki Kutatocsoport, Budapest); Lendvay, J. Izotoptechnika; 18: No. 6-7, 276-280(1975). (In Hungarian)

In closed system the quantity of developing ^{14}C-dioxide is proportional to the multiplication rate of bacteria. The method proves to be quick, sensitive, and quantitative. (auth)

17578 ORDERED DISTRIBUTION OF CARBON ISOTOPES IN INDIVIDUAL COMPOUNDS AND COMPONENTS OF THE LIPID FRACTION OF ORGANISMS. Galimov, E. M.; Shirinskii, V. G. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Geokhimiya; No. 4, 503-528(Apr 1975). (In Russian)

The carbon isotopic composition of narrow fractions and individual compounds of lipids isolated from plant and zooplankton samples has been investigated. The close correlation between the carbon isotopic composition and the values of β-factors of the investigated lipids is shown, what leads to the conclusion about the carbon isotopic-exchange equilibrium in the investigated system. A theoretically possible model of the realization of thermodynamical isotopic effects in biological systems is suggested on the basis of the isotopic-exchange equilibrium between the enzyme-substrate complex and the carbon structure being synthesized. (auth)

17579 DEVELOPMENT OF RADIOPHARMACOLOGY IN HUNGARY. Kertesz, L. (Orszagos Rontgen- es Sugarfizikai Intezet, Budapest); Kocsar, L. Izotoptechnika; 18: No. 6-7, 253-275(1975). (In Hungarian)

Diagnostic and therapeutic radiopharmaceuticals and their production in Europe and Hungary, administrative rules and regulations of isotope supply in Hungary, and development of application between 1970 and 1974 are discussed. As compared with some Socialist and developing countries, a backwardness in the in vivo diagnostics and therapy is observed, while a better position in the in vitro diagnostics can be seen. (ERB)

17580 SPECIES AND INTERSPECIES RADIOIMMUNOASSAYS FOR RAT TYPE C VIRUS p30: INTERVIRAL COMPARISONS AND ASSAY OF HUMAN TUMOR EXTRACTS. Charman, H. P.; White, M. H.; Rahman, R.; Gilden, R. V. (Flow Labs., Inc., Rockville, MD). J. Virol.; 17: No. 1, 51-59(Jan 1976).

The major internal protein, p30, of rat type C virus (RaLV) was purified and utilized to establish intra- and interspecies radioimmunoassays. Three rat viruses were compared in homologous and heterologous intraspecies assays with no evidence of type specificity. The only heterologous viruses to give inhibition in these species assays were the feline (FeLV) and hamster (HaLV) type C viruses; these reactions were incomplete and required high

virus concentrations. An interspecies assay using a goat antiserum prepared after sequentially immunizing with FeLV, RD 114, and woolly monkey virus p30's and labeled RaLV p30 was inhibited by all mammalian type C viruses, although preferentially by RaLV, FeLV, and HaLV. Thus, as in a previously reported assay developed with HaLV p30, rat, hamster, and cat p30's seem more closely related to each other than to mouse type C virus p30. High levels of specific antigen were found in all cell lines producing rat virus, whereas embryonic tissues from several rat strains and cell lines considered virus-free based on other tests were negative for p30. Rats bearing tumors containing Moloney murine sarcoma virus (RaLV) did not contain free circulating antibody to RaLV p30. Fifty-one human tumor extracts (including two tumor cell lines) were tested for activity in the RaLV species and 47 in the interspecies assays after Sephadex gel filtration and pooling of material in the 15,000- to 40,000-molecular-weight range. At a sensitivity level of 7 ng/ml (0.7 ng/assay) in the interspecies assay, all human tissues, with one exception, were negative. The one positive result is considered nonspecific based on proteolysis of the labeled antigen. Input tissue protein of the purified tumor extracts averaged 1.9 mg/ml with a range of less than 0.025 to 22 mg/ml. Tissues from NIH Swiss mice processed in the same manner were positive in the interspecies assay but negative in the intraspecies RaLV assay. (auth)

17581 RADIOIMMUNOASSAY OF GASTRIN. McGuigan, J. E. (Univ. of Florida, Gainesville). J. Am. Med. Assoc.; 235: No. 4, 405-406(26 Jan 1976).

The use of gastrin radioimmunoassay for differentiating between the Zollinger–Ellison syndrome and common peptic ulcer is discussed. This technique makes it possible to detect the syndrome with greater certainty than measurement of gastric acid secretion. Other clinical disorders in which increased serum gastrin levels occur are pernicious anemia, chronic gastritis, achlorhydria, renal failure, and intestinal resection. (HLW)

17582 BONE TUMOR BY SCINTIGRAPHY OF THE SKELETON, MARROW RETICULOENDOTHELIAL SYSTEM, AND THE PROLIFERATIVE TISSUE. Okuyama, S.; Ito, Y.; Awano, T.; Yamaura, H.; Takeda, S.; Sato, T.; Matsuawa, T. (Tohoku Univ., Sendai). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 125: No. 4, 965-971(Dec 1975).

Paralleled clinical studies of radioisotopic imaging or tumor metastases in the bone were undertaken with Tc/sup 99m/ pyrophosphate, Ga^{67} citrate, and Tc/sup 99m/ sulfur colloid. All three were capable of anticipating the bone roetgenograms. A critical analysis suggested that positive delineation with ^{67}Ga citrate would sometimes be superior to the others. This deserves further investigation. Clinically the combined use of Tc/sup 99m/ pyrophosphate with ^{67}Ga for the chest areas and extremities or with Tc/sup 99m/ colloid for the pelvic and abdominal areas would be more fruitful in early detection and exact localization of bone metastases. (auth)

17583 CLINICAL SCINTILLATION IMAGING. Second Edition. Freeman, L. M.; Johnson, P. M. (eds.). New York; Grune and Stratton, Inc. (1975). 834p.

Fundamental and clinical considerations in scintillation imaging are discussed in detail. Included in the discussion of fundamental considerations are: the evolution of scintillation imaging; radioactive agents for imaging; instrumentation and information portrayal; the scintillation image; rapid-sequence imaging; and radiation safety for patient and personnel. Clinical considerations include: cardiovascular imaging; central nervous system; kidney; liver; lungs; osseous system; pancreas; placenta; spleen; and thyroid. Progress and prospectives in scintillation imaging are also discussed. (ERB)

17584 EXPERIENCE WITH TECHNETIUM-99 LABELLED PYROPHOSPHATE. "A Superior Bone Scanning Agent". Richards, P. A. C. Radiographer; 22: No. 3, 89-92(Sep 1975).

The mechanism of the localization of Tc (Sn) pyrophosphate in bone is discussed. The preparation of the radiopharmaceutical is described and examples of its use are given. (AT)

17585 ACCURACY OF /sup 99m/Tc-DIPHOSPHONATE BONE SCANS AND ROENTGENOGRAMS IN THE DETECTION OF PROSTATE, BREAST AND LUNG CARCINOMA METASTASES. Osmond, J. D. III (Cape Cod Hospital, Hyannis, MA); Pendergrass, H. P.; Potsaid, M. S. Am. J. Roentgenol., Radium Ther. Nucl. Med.; 125: No. 4, 972-977(Dec 1975).

From 74th annual meeting of the American Roentgen Ray Society; Montreal, Quebec, Canada (25 Sep 1973).

A /sup 99m/Tc-diphosphonate scan is a sensitive detector of bony metastases of breast, prostate, and lung cancer. For these particular neoplasms, a negative bone scan in an asymptomatic patient is adequate evidence for absence of bony metastases and a correlative roentgenographic examination may not be necessary. Positive studies demonstrating multiple characteristic discrete areas of increased activity should be considered strong evidence for metastases. Single equivocal lesions require roentgenographic and occasionally biopsy correlation. If roentgenography fails to reveal the source of increased uptake (e.g., degenerative disease) the scan lesion should remain suspicious for metastases. (auth)

17586 WHOLE BODY TRANSMISSION-EMISSION SCANNING WITH WHOLE BODY CAMERA. Suzuki, Y.; Mori, H.; Michigishi, T.; Hisada, K.; Matsudaira, M. (Kanazawa Univ. Hospital, Japan). Am. J. Roentgenol., Radium Ther. Nucl. Med.; 125: No. 4, 978-980 (Dec 1975).

Whole body transmission-emission scanning was carried out using a whole body camera. A disk source 30 cm in diameter filled with /sup 99m/Tc was used for transmission scanning. Correct interpretation of emission scanning requires accurate anatomical orientation of the images. The value of whole body transmission-emission scanning is emphasized. (auth)

17587 CURRENT STATUS OF INDIUM-111 LABELED BLEOMYCIN FOR TUMOR DETECTION. Taylor, R. D.; Blahd, W. H. West. J. Med.; 123: No. 5, 386(Nov 1975).

The advantages and disadvantages of ^{111}In-labeled bleomycin for tumor detection are briefly mentioned. Indium-111 labeled bleomycin does localize in human tumors. However, its role in tumor detection and staging as compared with ^{67}Ga is still somewhat controversial. (ERB)

17588 CEREBRAL FLOW STUDIES DONE WITH BRAIN SCAN. Uszler, J. M. West. J. Med.; 123: No. 5, 387(Nov 1975).

The most commonly used brain scanning agent is ^{99m}Tc-pertechnetate. The same radiopharmaceutical dose used for brain scanning is also used for the cerebral blood flow study which is seen to enhance brain scanning by adding a hemodynamic evaluation. (ERB)

17589 THYROID CANCER FOLLOWING JUVENILE NECK IRRADIATION: A NEW ROLE FOR THYROID IMAGING. Hoffer, P. B.; Okerlund, M. West. J. Med.; 123: No. 5, 387-388(Nov 1975).

Technetium-99m-labelled pertechnetate in combination with a gamma camera produces very high resolution thyroid images. In patients with a history of neck irradiation, nonpalpable cold nodules can now be detected. Either a palpable nodule or nonpalpable cold area on scintiphoto is sufficient indication to at least consider surgical operation. (ERB)

17590 ABNORMAL BRAIN SCAN FINDINGS RESULTING FROM PRIOR ELECTROENCEPHALOGRAMS. Taylor, A. Jr. West. J. Med.; 123: No. 5, 388(Nov 1975).

A brain scan and electroencephalogram are often used in combination to evaluate patients with neurologic symptoms. Because an electroencephalogram may result in minor scalp trauma and localized radionuclide accumulation, the brain scan should be carried out first or delayed 48 hours after the electroencephalogram. (ERB)

17591 GALLIUM-67 TUMOR IMAGING. Waxman, A. D.; Siemsen, J. K. West. J. Med.; 123: No. 5, 388-389(Nov 1975).

Gallium-67 citrate has gained wide use, although it has not been accepted as a routine test in nuclear medicine because of the variability of uptake in bowel, liver, spleen, and bone marrow and the nonspecificity of gallium for tumors. Despite the pitfalls, valuable clinical information can be obtained in a noninvasive fashion and in special instances a gallium scan may be the only test of merit. (ERB)

17592 NONINVASIVE RADIONUCLIDE IMAGING OF DAMAGED MYOCARDIAL TISSUE. Alazraki, N. West. J. Med.; 123: No. 5, 389(Nov 1975).

Technetium-99m stannous pyrophosphate has been used successfully in the imaging of recent myocardial infarctions. Old infarctions are insensitive to the radiopharmaceutical. Thallium-201 localizes in normal myocardial tissue and thus may play a complementary role to the ^{99m}Tc scan. Potassium-43, ^{123}Cs, and ^{81}Rb have been tested as indicators of myocardial perfusion but have disadvantages such as high cost and relatively poor resolution. (ERB)

17593 ROLE OF INHALATION LUNG SCANS IN THE DIAGNOSIS OF PULMONARY EMBOLUS. Lyons, K. R. West. J. Med.; 123: No. 5, 389-390(Nov 1975).

The primary indication for the use of perfusion lung scanning is in cases of suspected pulmonary embolus. Simultaneous radiographic imaging is required to distinguish primary pulmonary embolus from secondary perfusion defects. Methods for making the distinction are discussed. (ERB)

17594 SCINTIGRAPHIC DIAGNOSIS OF SPLENIC INJURIES. Siemsen, J. K.; Telfer, N. West. J. Med.; 123: No. 5, 390-391 (Nov 1975).

Splenic scintigraphy is indicated in cases of blunt abdominal trauma. Radiocolloids are particularly useful in these cases. Concomitant liver images aid in evaluation of possible hepatic involvement. (ERB)

17595 RADIONUCLIDE SCINTIGRAPHY IN CYANOTIC HEART DISEASE. Gates, G. F. West. J. Med.; 123: No. 5, 391(Nov 1975).

Pulmonary blood flow measurements using ^{99m}Tc-macroaggregated albumin are useful in diagnosing cyanotic heart disease. Interpretation of the scans obtained in this rapid safe procedure is discussed. (ERB)

17596 ROLE OF LIVER AND BONE SCANNING IN EVALUATION OF POSSIBLE METASTATIC DISEASE. Brown, T. West. J. Med.; 123: No. 5, 392(Nov 1975).

Although the detection efficiency of liver scanning for liver metastases is low (70 to 80 percent) it is still more sensitive than the usual clinical and laboratory measurements in detecting hepatic metastases. A recent survey indicated also that the bone scan is the diagnostic method of choice in skeletal evaluation. Although the bone scan is highly sensitive, its lack of specificity must be noted. Simultaneous x-ray films of abnormal scan areas should rule out nonneoplastic causes of the abnormal scan. (ERB)

17597 GALLIUM-67 FOR THE DIAGNOSIS AND LOCALIZATION OF SUBPHRENIC ABSCESSES. Hopkins, G. B.; Mende, C. W. (Scripps Memorial Hospital, La Jolla, CA). West. J. Med.; 122: No. 4, 281-284(Apr 1975).

Four septic patients with suspected subphrenic abscesses were evaluated with gallium-67 citrate and technetium-99m labeled radiopharmaceuticals. Gallium-67 scintigraphs proved instrumental in correctly diagnosing and localizing one left and three right subphrenic abscesses. Gallium-67 scintigraphy can be a useful noninvasive technique for evaluating patients with suspected subphrenic abscess. (auth)

MATERIALS

17598 (CNLM-5716) PROGRAM COST ESTIMATE FOR ADVANCED HIGH TEMPERATURE MATERIALS. Fiscal Years 1965–1966. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 29 May 1964. Contract AT(30-1)-2789. 28p. Dep. NTIS $4.00.
Declassified 7 Nov 1975.
Costs are summarized for research programs on Nb–Zr–C metallurgy, low-density liquid alloys, nonaging Nb alloys, properties of advanced fuels, UN–W cermet, boiling liquid metals, protective coatings, corrosion, and space radiator. FY-1964 progress and expected FY-1965 results are also summarized for each program. (DLC)

17599 PLUTONIUM-DOKUMENTATION, TRANSPLUTONIUM-ELEMENTE, BAND 9, HEFT 2, FEBRUAR 1975. Referate-Zeitschrift, 211 Referate (Register-Nr. 438-808), 89 Referate (Register-Nr. 86T-174T). (Plutonium-documentation, Transplutonium-Elements, Volume 9, No. 2, February 1975. Abstract Journal, 211 Abstracts (Register-No. 438-808), 89 Abstracts (Register-No. 86T-174T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1975). vp. (In German and English)

17600 PLUTONIUM-DOKUMENTATION, TRANSPLUTONIUM-ELEMENTE, BAND 9, HEFT 1, JANUAR 1975. Referate-Zeitschrift, 236 Referate (Register-Nr. 1-437), 85 Referate (Register-Nr. 1T-85T). (Plutonium-Documentation, Transplutonium-Elements, Volume 9, No. 1, January 1975. Abstract Journal, 236 Abstracts (Register-No. 1-437), 85 Abstracts (Register-No. 1T-85T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1975). vp. (In German and English)
Among the entries are papers of the 1974 Winter Meeting of the American Nuclear Society. (DLC)

17601 PLUTONIUM-DOKUMENTATION, TRANSPLUTONIUM ELEMENTE, BAND 9, HEFT 4, APRIL 1975. Referate-Zeitschrift, 201 Referate (Register-Nr. 1204-1556), 75 Referate (Register-Nr. 259T-333T). (Plutonium-Documentation, Transplutonium-Elements, Volume 9, No. 4, April 1975. Abstract Journal, 201 Abstracts (Register-No. 1204-1556), 75 Abstracts (Register-No. 259T-333T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1975). vp. (In German and English)

17602 PLUTONIUM-DOKUMENTATION, TRANSPLUTONIUM-ELEMENTE, BAND 9, HEFT 5, MAI 1975. Referate-Zeitschrift, 175 Referate (Register-Nr. 1557-1850), 67 Referate (Register-Nr. 334T-400T). (Plutonium-Documentation, Transplutonium-Elements, Volume 9, No. 5, May 1975. Abstract Journal, 175 Abstracts (Register-No. 1557-1850), 67 Abstracts (Register-No. 334T-400T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1975). vp. (In German and English)

17603 PLUTONIUM-DOKUMENTATION, TRANSPLUTONIUM-ELEMENTE, BAND 8, HEFT 1-12. Referate-Zeitschrift. Jahresregister, 1974. (Plutonium-Documentation, Transplutonium Elements, Volume 8, No. 1-12. Abstract Journal. Annual Index, 1974). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1975). vp. (In German and English)

17604 NEW SUPERCONDUCTING CRITICAL TEMPERATURES AND FIELDS. Matthias, B. T. (Univ. of California, San Diego, La Jolla). IEEE Trans. Magn.; MAG-11, No. 2, 154(Mar 1975).
From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.
New compounds with higher T/sub c/ are discussed briefly: the Mo sulfides, hexagonal MoN, and cubic $LiTi_2O_4$. (DLC)

Ceramics and Cermets

Refer also to abstracts 17688, 17720, 17777, 19465, 19466, and 19603.

17605 (CEA-CONF-3071) SPECIFIC HEAT OF ACTINIDE COMPOUNDS AT LOW TEMPERATURE. de Novion, C. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). 1975. 8p. (In French). INIS.
From meeting on calorimetry and thermal analysis; Grenoble, France (22 May 1975).
Actinide compounds show phenomena of self-heating and recovery of self-irradiation induced defects which imply the development of apparatus and special methods for the measurement of their specific heat at low temperature. The case of insulating or semiconductor compounds is considered, with emphasis on the oxides MO_2. The problem of 5f electrons in metallic compounds, then pure metals and the self-irradiation problems are examined. (FR)

17606 (CEA-CONF-3073) DIFFUSION PHENOMENA IN ACTINIDE COMPOUNDS. Schmitz, F. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). 1975. 11p. (In French) INIS.
From colloquium of the French Chemical Society; Odeillo, France (25 Apr 1975).
The U diffusion in UO_2, UO_{2+x} and UC and the Pu diffusion in $(UPu)O_{2-x}$ were studied. The influence of irradiation on the diffusion phenomena is discussed. (FR)

17607 (CNLM-3599) FUEL ELEMENT DEVELOPMENT CHARTS. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 14 Apr 1961. 25p. Dep. NTIS $3.50.
Declassified 8 Jan 1972.
Fuel element development charts are presented for UO_2–BeO cores. Charts are included on irradiation performance, fuel pin irradiation, fission gas release, fuel pin design, and fuel pin fabrication. Diagrams of assemblies and test equipment are also included. (JRD)

17608 (CNLM-5757) IRRADIATION OF LITHIUM HYDRIDE. Slotnick, H. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 24 Jun 1964. Contract AT(30-1)-2789. 15p. Dep. NTIS $3.50.
Declassified 8 Dec 1975.
A review was made of the literature on lithium hydride irradiation tests. A condensed summary tabulation and review enumeration are presented. (DLC)

17609 (CNLM-5789) POST-IRRADIATION EXAMINATION REPORT OF NDA CAPSULES 67, 68, AND 69. Frank, J. E.; Felber, F. F. Jr. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 10 Sep 1964. Contract AT(30-1)-2789. 69p. Dep. NTIS $4.50.
Declassified 23 Mar 1972.
Results of metallographic examination, μ isotopic analysis, and fission gas analysis of UO_2–Nb fuel specimens are presented. The metallurgical specimens were examined for centerline melting, clad bonding, fuel swelling at the core ends, weld condition, porosity around the UO_2 agglomerates, matrix structure, clad-to-core compatibility, and UO_2–Nb compatibility. No evidence of centerline melting was observed. The cladding–core bonding was generally sound. A few spotty areas were observed in which a lack of bonding was noted. Other areas were noted in which the lack of bond could be attributed to shear stresses incurred during test. Axial fuel swelling was noted only in two of the twelve end speciments. The maximum swelling was 5 mils. All end cap welds were sound and continuous. The porosity of the UO_2 particles and agglomerates was generally uniform. Minor radial and axial cracks were observed in all cores. The Nb matrix was broken only where relatively large cracks occurred. Fine cracks propagating at a 45° angle from radial cracks suggest that the fine cracks were produced by shear stresses. No evidence of clad–core incompatibility was observed. The claddings of all irradiated specimens and an as fabricated control specimen had microstructures characteristic of oxidation of the Nb–1Zr alloy. No evidence of incompatibility was observed between the UO_2 agglomerates and the Nb matrix. Some unidentified phases (not oxide or reduced uranium) were observed in the Nb matrix. The ^{235}U fission burnups ranged as follows: Capsule 67: 15.30 to 16.83 atom percent, Capsule 68: 8.14 to 8.47 atom percent and Capsule 69: 11.70 to 15.15 atom percent. A tabulation of uranium isotopic analysis and burnup results is given along with results of the fuel cover gas analysis. (auth)

17610 (CNLM-6092) FUEL DEVELOPMENT CONTRIBUTION TO WORK STATEMENT, FY-1965. Freed, M. S. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 15 Jan 1965. Contract AT(30-1)-2789. 3p. Dep. NTIS $3.50.
UC and UN fuels development for SNAP-50/SPUR reactors is reported. (DLC)

17611 (FRNC-CONF-127) MICROCALORIMETRIC STUDY OF METAL-INSULATOR TRANSITIONS. Coey, J. M. D.; Roux-Buisson, H.; Schlenker, C.; Lakkis, S.; Dumas, J. (Centre

National de la Recherche Scientifique, 38-Grenoble (France)). 1975. 7p. (In French). INIS.

From meeting on calorimetry and thermal analysis; Grenoble, France (22 May 1975).

The specific heat of Ti, V and W oxides in the transition region was measured with a Perkin-Elmer DSC-2 differential enthalpic analyzer. The results obtained for each oxide are given and the value of the calorimetric measurements in this field is discussed. (FR)

17612 (KFK-EXT-6/75-2, pp 1-13) PREPARATION AND PROPERTIES OF TaC-HfC HARD MATERIALS. Nazare, S.; Ondracek, G. May 1975. (In German)

8 figs.; 2 tabs.; 16 refs.

In structure, preparation and properties of refractory compounds and systems. Second semi-annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Werkstoffkunde 2).

Investigations into the mixed carbide system TaC-HfC, which represents one of the most high-melting systems (>4,273 K), deal with the preparation of these carbides and the influence of the carbon content in mixed carbide on Young's modulus, electrical resistance and on the thermal expansion. (DE)

17613 (KFK-EXT-6/75-2, pp 14-29) INFLUENCE OF THE ANNEALING TEMPERATURE ON THE HARDNESS OF CARBIDES OF THE SYSTEM Ti-Ta-C. Holleck, H.; Schweitzer, H. May 1975. (In German)

12 figs.; 1 tab.; 17 refs.

In structure, preparation and properties of refractory compounds and systems. Second semi-annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Werkstoffkunde 2).

Investigations on the influence of annealing treatment at different temperatures on the hardness of multicomponent systems through possible long-range order, close-range order or close segregation. Using the example of the Ti-Ta-C system, the problematics is dealt with in detail. (DE)

17614 (KFK-EXT-6/75-2, pp 30-37) PREPARATION, HARDNESS PROPERTIES AND OXIDATION OF HARD METALS MADE OF (Ta,Hf)C-MIXED CARBIDES. Scholz, B. May 1975. (In German)

7 figs.; 1 tab.; 3 refs.

In structure, preparation and properties of refractory compounds and systems. Second semi-annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Werkstoffkunde 2).

Hard metals based on tantalum carbide, hafnium carbide and mixed carbide each with 5 wt.% of five different binder metals (Ni, Co, ATS 290, ATS 113, AISI 306 L) were hot-pressed under a load of 230 kp/mm^2. The temperature dependence on the sintering density and hot hardness is illustrated in density-temperature curves as well as in hardness-temperature curves. The course of oxidation on hot-pressed samples was gravimetrically traced at 600, 800 and 1,000°C and almost linear scale isotherms were found. The slope of the curve leads to the conclusion that a phase boundary reaction, and not the diffusion, is the rate determining partial step. Hard metals on a mixed carbide basis clearly show a more favorable scaling behavior than those on a single carbide basis. (DE)

17615 (KFK-EXT-6/75-2, pp 68-87) HOT HARDNESS OF Ta-CARBONITRIDES AFTER HOMOGENIZATION AND DIFFERENT HEAT TREATMENTS. Ritzhaupt-Kleissl, H. J. May 1975. (In German)

27 figs.; 4 refs.

In structure, preparation and properties of refractory compounds and systems. Second semi-annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Werkstoffkunde 2).

Tantalum carbonitride samples of a composition on the section TaC-TaN were subjected to homogenation annealing (2,000°C, 600 mm Hg N_2 for up to 50 mol % TaN after weighing and 1,800°C, 50 at N_2 for more than 50 mol % after weighing) and to obtain precipitates underwent various annealing treatments (1,200-1,400°C, high vacuum or 1 at N_2, 40 or 70 hrs). The temperature dependence of the hot hardness was measured between 300 and 1,300°C at a testing load of 2 kp. The slope of the hot hardness can be separated into a low and high temperature branch. The boundary between the two is between 800-1,000°C. Whereas the hardness in the low temperature branch only gradually decreases and still has a value of about 1,000 kp/mm^2 at 800°C, it decreases more strongly in the high temperature branch and has a value of 200 and 400 kp/mm^2 in general at a temperature of 1,300°C. Furthermore, the hot hardness is presented over the N/(N + C) ratio of the samples at different temperatures for each annealing. Finally, the results of the hardness measurements at room temperature, in the low and high temperature region are discussed and differences are concluded. It can be seen from the comparison of the experimental results that Ta carbonitride with a N/(N + C) ratio of about 0.4 to 0.5 after precipitation annealing of 40 hrs. at 1,300°C in high vacuum proves to have the best hardness properties. (DE)

17616 (KFK-EXT-6/75-2, pp 88-90) INVESTIGATIONS ON HARD METALS BASED ON (Ta,Hf)(C,N). Komac, M.; Kosmac, T. May 1975. (In German).

In structure, preparation and properties of refractory compounds and systems. Second semi-annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Werkstoffkunde 2).

The investigations on the preparation and properties of hard metals based on Ta(C,N) were extended to the alloys with (Ta,Hf)(C,N) mixed crystals. The hard metal samples were prepared by sintering with the liquid phase. Pure Ni and two Ni alloys NiB 0.1 and NiCo50 were used as binder metals. Boron and cobalt were added as alloy additions to the metallic Ni in order to examine their influence on the properties of the samples. Besides the phase composition, the density, bending strength, hardness and resistance to wear were determined on the finished samples. The two alloy additions either hardly influence the hardness and bending strength or even deteriorate these. On the other hand, boron additions increase the wear resistance of (Ta,Hf)(C,N) based hard metals and thus make the Ta(C,N) based hard metals equivalent or even superior. (DE)

17617 (KFK-EXT-6/75-2, pp 91-93) SINTERING AND WETTING STUDIES ON (Ta,Hf)-CARBONITRIDES WITH Ni-BINDER. Kosmac, T.; Trontelj, M.; Komac, M. May 1975. (In German).

In structure, preparation and properties of refractory compounds and systems. Second semi-annual report 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (TH)(F. R. Germany). Inst. fuer Werkstoffkunde 2).

Sinter curves of (Ta,Hf) carbonitrides of various composition and of carbonitride-based hard metals with 10 to 15% Ni binder were recorded. Similar to Hf-free samples, the sinter curves can be divided into several temperature regions, where below 1,300°C non-activated sintering in the solid state and above 1,300°C, activated sintering in the solid state occurs. At 1,420°C, the occurrence of liquid state could be seen, a sufficient formation of this however, was first observed in the temperature region 1,500 to 1,630°C. The $TaNi_3$ concentration also increases simultaneously with increasing temperature. The wetting investigations were carried out on the Ta(C,N)-Ni($TaNi_3$) system and on the (Ta,Hf)(C,n)-Ni system according to the sessile drop method. Using nickel as metal components, melting temperatures of 1,420°C ± 15° and wetting angles of 5° which sink to below 5° in the case of the Hf-contained samples were found. Melting temperatures of 1,520°C ± 15° were measured for Ta(C,N)-$TaNi_3$ samples independent of the composition. The wetting angles vary according to sample composition and directly after melting are in the region between 20° and 50° with a reduction of about 3 to 10° within 10 min. (DE)

17618 (ORNL-5096) IRRADIATION BEHAVIOR OF Eu_2O_3 IN EBR-II EXPERIMENT BICM-1. Martin, M. M.; Pasto, A. E.; Donnelly, R. G. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. 38p. AT.

Europium oxide is an excellent candidate neutron absorber material for fast nuclear reactors. It can be fabricated readily into dense shapes, has a high nuclear worth that it retains during burnup, and does not generate gas and tritium when it captures neutrons. To determine its irradiation behavior, eight Eu_2O_3 test pellets of 7.6 mm diam by 7.6 mm high (0.3 by 0.3 in.) were fabricated to densities in excess of 90 percent of theoretical and irradiated in the instrumented BICM-1 experiment in EBR-II to a fluence of 6 x 10^{26} n/m^2 (greater than 0.11 MeV) at about 700°C (1292°F). Postirradiation examination showed Eu_2O_3/Type 316 stainless steel and Eu_2O_3/W-Re alloy to be compatible material systems and that Eu_2O_3 had retained most of its initial crystallinity. Hot-pressed cubic Eu_2O_3 pellets densified as a consequence of irradiation-induced sintering; their diameters decreased 0.5 percent and their edges chipped appreciably. Monoclinic Eu_2O_3 pellets dedensified from a combination of intergranular microcracks and both axial and circumferential macrocracks; their diameters in-

creased 3,9 percent and 3,6 percent, respectively, for hot-pressed and sintered products. (auth)

17619 (ORNL-tr-4073) METHOD FOR MAKING SiC COATINGS ON FISSILE OR FERTILE MATERIALS BY PYROLYSIS OF SILICO-ORGANIC COMPOUNDS. Drittler, K.; Luleich, H. 15 Jun 1972. Translated by M. Gerrard of German Patent 1,571,500. 4p. Dep. NTIS $4.25.

A method for making SiC coatings on fertile or fissile substances by pyrolysis of a silico-organic compound at temperatures greater than about 1000°C is described. The silico-organic compound is a halogen-free organo-silane with SiC, SiH, or Si–Si bonds and the pyrolysis takes place in one or two steps, the first of which is about 300 to 600°C. The pyrolysis is carried out in an inert or reducing or oxidizing atmosphere or in a high vacuum. (auth)

17620 SCANDIUM NITRIDE. Lyutaya, M. D.; Goncharuk, A. G.; Timofeeva, I. I. J. Appl. Chem. USSR (Engl. Transl.); 48: No. 4, 757-760(Apr 1975).

Translated from Zh. Prikl. Khim.; 48: No. 4, 721-724(Apr 1975).

During investigation of the kinetics of scandium nitride formation in a stream of nitrogen and ammonia with metallic scandium in the form of powder and filings as starting material it was established that the nitriding rate is considerably lower in ammonia than in nitrogen on account of the formation of hydrides as intermediate products. By chemical and x-ray methods of analysis a region of homogeneity was established in scandium nitride. (auth)

17621 CHARACTERISTICS OF THE FORMATION OF URANIUM OXYCARBIDES. Larin, A. A.; Vlasov, V. G. J. Appl. Chem. USSR (Engl. Transl.); 48: No. 4, 761-765(Apr 1975).

Translated from Zh. Prikl. Khim.; 48: No. 4, 725-729(Apr 1975).

Depending on the rate at which the carbon-thermal reduction is realized, it was found that uranium dioxide changes at once into the carbide or oxycarbide without the intermediate formation of the monoxide; uranium oxycarbides are formed when the process develops slowly at 1500 to 1650°C with a carbon monoxide pressure of 10^{-1} to 10^{-2} mm Hg. The existence of uranium oxycarbides over a wide range of homogeneity was established by gravimetric, chemical, and x-ray methods, and single-phase samples of $UC_{1-x}O_x$ (where x varies between 0.06 and 0.34) were identified. (auth)

17622 LOW TEMPERATURE DEPOSITION OF METAL NITRIDES BY THERMAL DECOMPOSITION OF ORGANOMETALLIC COMPOUNDS. Sugiyama, K.; Pac, S.; Takahashi, Y.; Motojima, S. (Gifu Univ., Kagamigahara, Japan). J. Electrochem. Soc.; 122: No. 11, 1545-1549(Nov 1975).

Decomposition reaction of dialkylamides of boron, silicon, tin, titanium, zirconium, niobium, and tantalum was investigated. The amides of transition metals decomposed to the corresponding nitrides at 300 to 500°C, whereas those of boron, silicon, and tin yielded elemental deposits at higher temperatures. In the deposition of titanium nitride from titanium tetrakis (dimethylamide), two optimum temperatures at 400° and at 800°C in nitrogen or hydrogen atmosphere were found, but in argon only low temperature deposition was possible. The low and high temperature processes are discussed in relation to mass spectral analysis of the exhaust gases formed at various decomposition temperatures of titanium amide. (auth)

17623 CRACK PROPAGATION AND FRACTURE IN SILICON CARBIDE. Evans, A. G. (Rockwell International, Thousand Oaks, CA); Lange, F. F. J. Mater. Sci.; 10: No. 10, 1659-1664 (Oct 1975).

Fracture mechanics and strength studies performed on two silicon carbides - a hot-pressed material (with alumina) and a sintered material (with boron) - have shown that both materials exhibit slow crack growth at room temperature in water, but only the hot-pressed material exhibits significant high temperature slow crack growth (1000 to 1400°C). A good correlation of the observed fracture behavior with the crack growth predicted from the fracture mechanics parameters shows that effective failure predictions for this material can be achieved using macro-fracture mechanics data. (auth)

17624 X-RAY INVESTIGATION OF THE NIOBIUM HYDROGEN PHASE DIAGRAM. Zabel, H.; Alefeld, G.; Peisl, H. (Univ., Munich). Scr. Metall.; 9: No. 12, 1345-1349(Dec 1975).

The two-phase coexistence of solid-solution H in Nb was measured by loading the Nb with a critical H concentration. It was found that the residual stresses in the Nb–H system are composed of the stresses due to the dislocations and the coherency stresses due to inhomogeneous distribution of H. Results are presented graphically. (JRD)

17625 EFFECT OF FORGING HISTORY ON THE STRENGTH AND MICROSTRUCTURE OF TDNiCr (Ni–20 Cr–2 ThO_2). Filippi, A. M. (Westinghouse Astronuclear Lab., Pittsburgh). Metall. Trans., A; 6A: No. 12, 2171-2177(Dec 1975).

Forging variables were evaluated to determine their influence on the elevated temperature strength and microstructure of TDNiCr. Grain size was the principal microstructural feature related to elevated temperature strength and was controlled primarily by the thermomechanical variables of forging temperature and final annealing condition. Results of tests at 2000°F revealed a factor of eight increase in tensile strength as grain size increased from 1 to 150 mu m, while stress-rupture strength improved by three to five times as grain size increased from 15 to 1500 mu m. Forged material of grain size greater than or equal to approximately 150 mu m displayed a level of elevated temperature strength comparable to that of optimized TDNiCr sheet. The presence of a preponderance of small twins and a strong preferred orientation may have also been factors contributing to the excellent high temperature strength of large grain forged material. (auth)

17626 KINETICS OF INITIAL STAGES OF Nb_2O_5 AND Ta_2O_5 ATOMIC HYDROGEN REDUCTION. Lavrenko, V. O.; Tikush, V. L.; Zenkov, V. S.; Vereshchak, V. M. (Inst. of Problems in Material Science, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 9, 854-858(Sep 1975). (In Ukrainian).

The kinetics of the initial stages of Nb_2O_5 and Ta_2O_5 reduction in a high-frequency hydrogen discharge at a pressure of 0.9 torr and temperature of 25 to 1000° C was studied by the vacuum microweight method and by the electronographic and petrographic analyses of the interaction products. (auth)

17627 EFFECT OF PRESSURE ON THE PROPERTIES OF MOLYBDENUM SULFIDE IN THE SUPERCONDUCTING AND NORMAL STATES. Alekseevskii, N. E.; Dobrovol'skii, N. M.; Nizhankovskii, V. I.; Tsebro, V. I. (Inst. of Physics Problems, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 2, 662-665(Aug 1975). (In Russian).

The effect of pressure on the critical superconducting transition T_c and critical magnetic field strengths H_c is investigated in superconducting molybdenum chalcogenides Mo_3SnS_3 and $Mo_3SnGa_{0.6}S_3$. The measurements are carried out in the 0 to 5 and 70 to 100 kbar pressure ranges. It is shown that T_c decreases with pressure and dT_c/dp considerably exceeds the respective value for ordinary metallic superconductors. (auth)

17628 CRITICAL PHENOMENA IN EuO. Borukhovich, A. S.; Marunya, M. S.; Bamburov, V. G.; Ignat'eva, N. I.; Gel'd, P. V. (Inst. of Chemistry, Sverdlovsk, USSR). Zh. Eksp. Teor. Fiz.; 69: No, 2, 565-571(Aug 1975). (In Russian).

The specific heat, magnetic susceptibility, and magnetization of europium monoxide samples of various composition are studied in the magnetic phase transition region. A correlation is established between thermodynamic parameters for the phase transition of the second kind in EuO_{1-x} and their magnetic characteristics. The results obtained are discussed under the assumption of existence in the monoxide, with a deficiency of oxygen, of bound magnetic polarons whose presence is responsible for the metal-insulator transition. This circumstance, and the contribution of magnetic dipole-dipole interaction, may be the cause of asymmetry of the polytherm C_p (T) in the critical region. (auth)

17629 FORMATION OF DEFECTS IN INDIUM PHOSPHIDE AND INDIUM ARSENIDE CRYSTALS IRRADIATED WITH FAST NEUTRONS. Kekelidze, N. P. (Tbilisi State Univ., USSR). Soobshch. Akad. Nauk Gruz. SSR; 80: No. 1, 81-83(Oct 1975). (In Russian).

The regularities of the emergence of radiation defects in InP and InAs crystals have been established. It is shown that irradiation causes the formation of radiation local potentials. The phenomenon of defect redistribution has also been found. (auth)

17630 TELLURIUM-IMPLANTED N^+ LAYERS IN GaAs. Pashley, R. D. (California Inst. of Tech., Pasadena); Welch, B. M. Solid-State Electron.; 8: No. 11, 977-981(Nov 1975).

Ion implantation of Te was investigated as a doping process for the fabrication of submicron n-type layers in GaAs. The implantation was performed with substrates held at 350°C. After implantation, a protective overcoat of AlN or Si_3N_4 was sputtered on the samples to prevent the GaAs from disassociating during anneal (900°C). The electrical characteristics of the n-type implants were then measured. Current-voltage and capacitance-voltage characteristics of implanted diodes indicated that the junctions were linearly graded and that there was no intrinsic

layer present after anneal. Sheet resistivity and Hall effect measurements were used to determine the surface carrier concentration and effective mobility in the implanted layers. Ionized impurity profiles extending beyond the implanted junction depth were calculated by matching differential Hall effect data with junction capacitance-voltage data. A peak electron concentration of 7×10^{18} electrons/cm^3 was observed. However, the profiles exhibited penetrating tails that resulted in junction depths being much deeper than the LSS range theory would predict. (auth)

17631 EPR STUDY OF EXCHANGE INTERACTIONS IN Eu/sub x/Yb/sub 1-x/B_6. Glaunsinger, W. S. (Arizona State Univ., Tempe). J. Magn. Resonance; 18: No. 2, 265-275(May 1975).

Exchange interactions in $Eu_xYb_{1-x}B_6$ have been studied by the EPR technique at 0.2 intervals in x at 296°K. In the region of the absorption maximum the experimental spectra can be described by a lineshape function consisting mainly of a Lorentzian absorptive component with a small admixture of a Lorentzian dispersive component. Graphs are presented which facilitate lineshape fitting and parameter extraction. Exchange fields are evaluated from the measured half-width at half-maximum power absorption and calculated dipolar, hyperfine, and crystal-field contributions to the second moment of the Eu^{2+} resonance. Assuming nearest-neighbor exchange interactions only, the magnitudes of the Weiss constants are calculated and are in good agreement with those derived from low-temperature static magnetic susceptibility measurements. The g-factors of Eu^{2+} are all considerably greater than that in the absence of exchange, indicating the existence of exchange interactions between the europium moments and conduction electrons. Narrow resonance signals at $g = 2.000 \pm 0.001$ have been detected in EuB_6 and $Eu_{0.8}Yb_{0.2}B_6$ and are attributed to conduction electrons. Possible exchange mechanisms are discussed, and it is concluded that exchange coupling via magnetic-polaron formation is the only mechanism that is consistent with the experimental results. (auth)

17632 LOW-RESISTIVITY n-TYPE LAYERS IN InAs/sub x/P/sub 1-x/ BY ION IMPLANTATION. Davies, D. E.; Kennedy, J. K.; Lowe, L. F. (Air Force Cambridge Research Labs., Bedford, MA). Electron. Lett.; 11: No. 19, 462-463(18 Sep 1975).

$InAs_xP_{1-x}$ has been implanted with sulfur and silicon with the view of forming low-resistivity n-type layers. Resulting activity from 10^{15} cm^{-2} implants indicate SiO_2 to be an adequate encapsulant at the required 700 to 750°C annealing. Sheet resistivities down to 2.5 to 3, 4 and 8 Ω/□, respectively, are obtained for the three compositions $InAs_{0.75}P_{0.25}$, $InAs_{0.5}P_{0.5}$ and $InAs_{0.2}P_{0.8}$ investigated. (auth)

17633 ESR BEHAVIOUR OF IRON IN GAMMA-IRRADIATED PYREX. Brown, G. (Royal Military Coll. of Science, Shrivenham, Eng.). J. Mater. Sci.; 10: No. 9, 1481-1486(Sep 1975).

Iron, present as an impurity in commercial Pyrex tube, is examined by electron spin resonance (esr) as a function of γ dose. The population of Fe^{3+} initially decreases and then, at a well-defined dose, abruptly begins to increase. This behavior is then correlated with lineshape changes to show that: (a) two distinct types of site must exist, occupied both by Fe^{2+} and by Fe^{3+}; (b) the site symmetry of the Fe^{3+} electron trap is different from that of the Fe^{2+} hole trap. Line-width considerations show that a wider range of crystal fields exist in Pyrex than in the simpler types of glass. (auth)

17634 SYNTHESIS AND PHYSICO-CHEMICAL INVESTIGATION OF SOLID SOLUTIONS OF Nd/sub 1-x/Ca/sub x/VO_3. Milova, G. D.; Bazuev, G. V.; Shveikin, G. P. (Inst. of Chemistry, Sverdlovsk, USSR). Zh. Neorg. Khim.; 20: No. 5, 1444-1447 (May 1975). (In Russian).

Solid solutions of $Nd_{1-x}Ca_xVO_3$ with a perovskite structure were synthesized in a vacuum from V_2O_3, VO_2, Nd_2O_3, and CaO at 1400°C. The formation in the system of two forms of the solid solution was established by x-ray and microscopic methods. The first is a $NdVO_3$-based orthorhombic form ($0 < x < 0.23$) and the second is a $CaVO_3$-based pseudocubic form ($0.32 < x < 0.1$). The parameters of the crystalline lattice in the limits of the homogeneity region regularly decrease with the substitution of the Nd^{3+} ion by Ca^{2+} and V^{3+} by V^{4+}. The character of the transition from the orthorhombic to the pseudocubic structure was analyzed by ir spectroscopic methods. (tr-auth)

17635 HIGH-TEMPERATURE STRENGTH OF A NIOBIUM–ZIRCONIUM NITRIDE EUTECTIC. Shurin, A. K.; Kozyrskii, G. Ya.; Sul'zhenko, V. K.; Barabash, O. M. (Inst. of Metal Physics, Kiev). Dokl. Akad. Nauk SSSR; 222: No. 6, 1332-1334 (21 Jun 1975). (In Russian).

A eutectic alloy of niobium–zirconium nitride contains about 10 mol % (12 vol %) ZrN. Zirconium nitride nuclei first crystallize out, and grow in the form of branched, laminar columns which attain a size of 80 μm in cross section. The thickness of the zirconium nitride lamina is 0.8 μm, and the distance between the lamina is 2.5 μm. With such a small thickness the dendritic crystals contain a small number of crystal defects, and have very high strength values which attain values 0.5 of theoretical. The strength and plasticity of the eutectic alloys depend on the state of the metal matrix. Since the limiting solubility of zirconium nitride in niobium is rather high (up to 5 wt %) and depends substantially on the temperature, it appears possible to use thermal treatment in order to change the properties of the alloy. Annealing of the alloy at 1200 to 1500°C leads to a decrease in the yield point and an increase in plasticity. The short-term and long-term strengths at high temperatures were determined on samples subjected to a one-hour anneal at 1400°C with subsequent cooling to 1000°C at a rate of 4 deg/min. The strength and yield point changed slightly to a temperature of 900°C, and decrease at high temperatures but maintain high values. With increasing temperature the elongation rises from 4.5% at room temperature to 50% at 1800°C. This alloy shows high heat strength. (SJR)

17636 DETERMINATION OF DEEP LEVELS IN SEMI-INSULATING CADMIUM TELLURIDE BY THERMALLY STIMULATED CURRENT MEASUREMENTS. Scharager, C.; Muller, J. C.; Stuck, R.; Siffert, P. (Univ., Strasbourg). Phys. Status Solidi (a); 31: No. 1, 247-253(Sep 1975).

Thermally stimulated current (TSC) measurements have been performed in high resistivity ($Q \approx 10^7$ Ωem) CdTe γ-ray detectors between 35 and 300°K. The TSC curves have been analyzed by different methods, including those taking into account the retrapping of the carriers. The traps characteristics have been determined; especially three levels located at $E_v + 0.13$ eV, $E_v + 0.30$ eV, and $E_c - 0.55$ eV have been investigated. (auth)

17637 MAGNETIC TRANSITION IN NEODYMIUM DIHYDRIDE: LOW-TEMPERATURE HEAT CAPACITY STUDIES. Bieganski, Z.; Opyrchal, J.; Drulis, M.; Stalinski, B. (Inst. for Low Temperature and Structure Research, Wroclaw). Phys. Status Solidi (a); 31: No. 1, 289-291(Sep 1975).

The low temperature specific heats of neodymium dihydride, $NdH_{2.00}$, were measured in the temperature range 1.8 to 22°K. A sharp λ-type specific heat anomaly due to a ferromagnetic transition has been found at $T_c = (6.2 \pm 0.1)$°K. The entropy change due to the magnetic contributions to the specific heat has been evaluated and interpreted. (auth)

17638 LUMINESCENCE OF ZnTe IMPLANTED BY Al IONS. Kwietniak, M.; Wardzynski, W. (Inst. of Electron Tech., Warsaw). Phys. Status Solidi (a); 31: No. 1, K47-K51(Sep 1975).

Al ions were implanted in ZnTe single crystals at 30 keV. An observed broad photoluminescence band with a maximum of about 5600 Å is attributed to recombination of donor-acceptor pairs. The position of the short-wavelength edge of the photoluminescence band corresponds to 5440 Å. Other features of the luminescence measurements are analyzed. (JRD)

17639 BORIDY. (Borides). Samsonov, G. V.; Serebryakova, T. I.; Neronov, V. A. Moscow; Atomizdat (1975). 376p.

This book generalizes and systemizes the available information on an important new class of compound, represented by the borides. A presentation is given of a detailed analysis of the chemical and crystal structure of metallic and nonmetallic borides. A look is taken at the chemical bond and electronic structure of borides, and the nature of their physical and chemical properties. Phase diagrams of all elements of the periodic table with boron are presented, and characteristics are given for the conditions of existence, the formation and properties of binary boride systems. A description is given for methods of producing the borides, and most important applied uses of the borides. This book is intended for scientists interested in the metallurgy of refractory compounds. 69 figs., 98 tables, 1028 references. (SJR)

17640 SPECTROSCOPY. I. Ferroelastic Phase Transitions in Trigonal Binary Molybdates and Tungstenates. Otko, A. I.; Pelikh, L. N.; Povstyanyi, L. V.; Nesterenko, N. M.; Kalinin, P. S.; Zvyagin, A. I. (Cryogenics Physicotechnical Inst., Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 4, 46-50(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 4, 697-701(1975).

Results of studies on low-temperature phase transitions in trigonal binary molybdates and tungstates are presented. In all crystals of these materials a domain structure develops below the transition temperature (Tc). For $T < Tc$, changes in the ESR spectra of Gd^{+3} and Fe^{+3} indicated reduction of the symmetry of the paramagnetic centers. Phase transitions were accompanied by negligible anomalies in the dielectric properties. (JRD)

17641 BAND STRUCTURE OF V_2O_3 AND Ti_2O_3. Ashkenasi, J.; Chuchem, T. (Hebrew Univ., Jerusalem). Philos. Mag.; 32: No. 4, 763-785(Oct 1975).

A previous calculation of the band structure of trigonal V_2O_3 and Ti_2O_3 by Nebenzahl and Weger (Nebenzahl, I. and Weger, M., 1969, Phys. Rev. vol. 184, 936; 1971, Phil.Mag. vol. 24, 1119) is improved, taking a more rigorous treatment and including the effect of covalency. Agreement with experiment is good. It is found that the width of the 3d band is about 9 eV for V_2O_3 and 11 eV for Ti_2O_3; this band is composed of a wide e_g and a narrow t_{2g} sub-band. The t_{2g} sub-band is the lower; its width is about 3 eV for V_2O_3 and 4 eV for Ti_2O_3, and the Fermi level lies within it. The density of states at the Fermi level is high for V_2O_3 and low for Ti_2O_3. It is shown that the inclusion of electron–electron interactions can bring about a metal-to-insulator transition in Ti_2O_3 in terms of a band-crossing model. (auth)

17642 DEFECT STRUCTURE OF NONSTOICHIOMETRIC VANADIUM DIOXIDE AT HIGH TEMPERATURES. Balabaeva, R. F.; Vasil'eva, L. A.; Gerasimov, Ya. I. (Moscow State Univ.). Dokl. Phys. Chem. (Engl. Transl.); 221: No. 1-3, 193-196(Mar 1975).

Translated from Dokl. Akad. Nauk SSSR; 221: No. 1, 113-116 (Mar 1975).

Previously reported studies on vanadium oxides indicated that the entire homogeneity range can be broken down into at least four regions, each of which is characterized by a definite type of defect or definite set of defects. Statistical and thermodynamic models were used to identify the chief type of defect: oxygen atom vacancies (v_O), vanadium in interstices (V_i), oxygen atoms in interstices (O_i), or vanadium vacancies (v_V). There was substantial agreement between experimental and calculated data. (JGB)

17643 EFFECT OF THE ADDITION OF RARE EARTH OXIDES ON THE STRUCTURE OF ZIRCONIUM AND HAFNIUM DIOXIDES. Vlasov, A. N.; Pal'guev, S. F. (Inst. of Electrochemistry, Sverdlovsk, USSR). Dokl. Phys. Chem. (Engl. Transl.); 221: No. 1-3, 236-238(Mar 1975).

Translated from Dokl. Akad. Nauk SSSR; 221: No. 2, 364-366 (Mar 1975).

Studies were performed on the passage from monoclinic to tetragonal or cubic ZrO_2 and HfO_2 by substitutional dissolution of rare earth oxides (R_2O_3) and formation of oxygen vacancies. It is concluded that the substitutional dissolution of R_2O_3 into monoclinic ZrO_2 and HfO_2 with formation of oxygen vacancies will, provided the associated volume changes are small and of the same order of magnitude as the thermal changes, lead to structural similitude between low-temperature solid-solution structures plotted along the concentration axis, and pure ZrO_2 or HfO_2 structures at temperatures plotted along the temperature axis. (JGB)

17644 EFFECT OF IRRADIATION ON THE OPTICAL ABSORPTION IN $BaTiO_3$. Kuz'min, I. I.; Solov'ev, S. P.; Vaisburd, D. I.; Zakurkin, V. V. (Scientific-Research Physical-Chemical Inst., Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 4, 87-89(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 4, 741-743(1975).

Radiation effects of electrons, protons, deuterons, and helium ions at 0.3 to 24 MeV on optical properties of $BaTiO_3$ were investigated. Vacancy defects lead to a decline in the number of absorption bands associated with the fundamental absorption edge. These bands merge and produce increased absorption. (JRD)

17645 WAVE-VECTOR DEPENDENCE OF THE JAHN–TELLER INTERACTIONS IN $TmVO_4$. Kjems, J. K. (Danish Atomic Energy Research Establishment, Risoe); Hayes, W.; Smith, S. H. Phys. Rev. Lett.; 35: No. 16, 1089-1092(20 Oct 1975).

The resonant Jahn–Teller coupling of the B/sub 2g/ acoustic phonon and the Zeeman-split ground doublet in $TmVO_4$ was studied by inelastic neutron scattering. Tuning of the magnetic field provides a means for investigating the wave-vector dependence of the interactions. We find that the coupling is constant in the region where the phonon dispersion is linear, up to 0.4 of the distance to the zone boundary. This agrees with the predictions of a Debye model. (auth)

17646 ^{160}Dy AND ^{166}Er MÖSSBAUER STUDIES OF CONCENTRATED AND DILUTED RARE-EARTH DIHYDRIDES: SINGLE-LINE COMPOUNDS AND CRYSTAL-FIELD EFFECTS. Stöhr, J.; Cashion, J.D. (Physik Department, Technische Universität München, D-8046 Garching, Germany). Phys. Rev. B 12: No. 11, 4805-4811 (1 Dec 1975).

Mössbauer-effect measurements on the cubic intermetallic rare-earth dihydrides are reported utilizing the 86.8-keV and the 80.6-keV $2^+ \rightarrow 0^+$ γ transitions of ^{160}Dy and ^{166}Er, respectively. All studies were carried out at liquid-helium temperatures on pure and diluted (with Y or Sc) paramagnetic samples. It is found that in the more concentrated alloys spin-spin ($4f$-$4f$) relaxation rates at 4.2 K are sufficiently fast to allow for the use of these systems as narrow-single-line Mössbauer sources and absorbers. Measurements on highly dilute ^{160}Dy and ^{166}Er impurities in YH_2 reveal the resolved paramagnetic hyperfine structure of a Γ_7 crystalline electric field (CEF) ground state in both cases. The results are discussed in terms of CEF theory. (auth)

17647 SPECIFIC HEAT AND MAGNETIZATION OF THE SUPERCONDUCTING MONOXIDES: NbO AND TiO. Okaz, A.M.; Keesom, P.H. (Physics Department, Purdue University, West Lafayette, Indiana 47907). Phys. Rev. B 12: No. 11, 4917-4928 (1 Dec 1975).

The specific heat of five NbO_x samples (x between 0.96 and 1.02) is reported for the Meissner, mixed, and normal states. The specific heat of seven TiO_x samples, covering the range of composition from 0.91 to 1.17, is discussed and compared to previous work. For NbO, the transition temperature T_0 reaches a maximum of 1.61 K near $x = 1.0$; for TiO, the transition temperature is not a function of composition. The densities of states of both systems are derived from the coefficients of the electronic specific heat γ and compared to the band-structure calculations. While NbO is found to be a low-κ intrinsic type-II superconductor, TiO is a high-κ dirty type-II material. Magnetization measurements on six NbO_x samples indicate that a deviation of stoichiometry by 1 at.% on the low oxygen side produces a multiphase system; the majority of such a sample is NbO and the minor phase is free Nb metal with a transition temperature around 6 K. Although magnetization data indicate too large a fraction for the minor phase, specific-heat data show a more reasonable value for this fraction. (auth)

17648 DYNAMICS OF COLORATION OF AMORPHOUS ELECTROCHROMIC FILMS OF WO_3 AT LOW VOLTAGES. Crandall, R.S.; Faughnan, B.W. (RCA Laboratories, Princeton, New Jersey 08540). Appl. Phys. Lett. 28: No. 2, 95-97 (15 Jan 1976).

Measurements of the time dependence of the coloration (formation of H_xWO_3) of amorphous films of WO_3 are described and analyzed in terms of a barrier for current flow at the WO_3-electrolyte interface. A novel feature is that as coloration proceeds, the chemical potential of hydrogen in the H_xWO_3 increases, opposing further coloration. (auth)

17649 THEORY OF PARAMAGNETIC SINGLET-DOUBLET EXCITATIONS IN DOUBLE-HEXAGONAL CLOSE-PACKED PRASEODYMIUM. Bak, P. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. B 12: No. 11, 5203-5212 (1 Dec 1975).

The magnetic excitation spectrum of the singlet-doublet magnet double-hexagonal close-packed praseodymium, which has been measured by means of inelastic neutron scattering, is analyzed using a diagrammatic high-density expansion technique. The lowest-order random-phase-approximation diagrams give a detailed description of the wave-vector and temperature dependence of the four modes in terms of a Hamiltonian including isotropic Heisenberg interatomic exchange interactions and anisotropic, dipolar like exchange interactions. In general, the modes are linearly or elliptically polarized. The leading contributions to the line shapes of the excitations are obtained by extending the $1/Z$ expansion of the generalized susceptibility propagators one order beyond the random-phase approximation. This damping corresponds to spin-wave scattering on single-site fluctuations. The propagators are calculated self-consistently by including internally renormalized Green's functions. The theoretical spectral functions are in detailed agreement with experiment. (auth)

17650 LOW TEMPERATURE SPECIFIC HEAT OF $(V_{1-x}Cr_x)_2O_3$ AND $(V_{1-x}Al_x)_2O_3$. Wenger, L.E.; Keesom, P.H. (Department of Physics, Purdue University, West Lafayette, Indiana 47907). Phys. Rev. B 12: No. 11, 5288-5296 (1 Dec 1975).

In order to provide an independent determination of the hyperfine splitting of the vanadium nucleus in the antiferromagnetic insulating state, the nuclear specific heats of $(V_{1-x}Cr_x)O_3$ and $(V_{1-x}Al_x)_2O_3$ with $0.012 \leq x \leq 0.085$ were measured below 1 K. The average hyperfine field value of 188.6 kOe is in better agreement with NMR results on V_2O_3 than previous heat-capacity measurements. For $x < 0.04$, the specific heat, after subtracting the nuclear contribution, is described by a Debye lattice specific heat proportional T^3. However for $x > 0.04$, this nonnuclear specific heat for the as grown specimens consists not only of a cubic temperature-dependent contribution but also of an anomalous contribution which is linearly dependent on the temperature. After annealing these specimens, the linear temperature-dependent term completely disappears. This anomalous specific heat shows a striking similarity to that of amorphous materials and may likewise result from localized defects whose density is reduced upon annealing the specimens. The observation of longer thermal relaxation times in these annealed specimens gives further support to the similarity with amorphous materials. (auth)

17651 ELECTRICAL CONDUCTIVITY OF VANADIUM PENTOXIDE IN STRONG ELECTRIC FIELDS. Chernenko, I.M.;

Ivon, A.I. (Dnepropetrovsk State University). Sov. Phys.—Solid State 17: No. 5, 935-936 (May 1975).

This paper reports the results of a study of the electrical conductivity of vanadium pentoxide (V_2O_5) in electrical fields of 0–10^4 V/cm at temperatures from 77 to 115°K. (auth)

17652 CRYSTALLOGRAPHY AND PROPERTIES OF LANTHANUM OXYTUNGSTATE, La_2WO_6. Yanovskii, V.K.; Voronkova, V.I. (M. V. Lomonosov State University, Moscow). Sov. Phys.—Crystallogr. 20: No. 3, 354-355 (May 1975).

The crystallographic, optical, and dielectric characteristics of lanthanum oxytungstate crystals, obtained by crystallization from solution in a melt, have been studied. The chemical composition of the crystals can be represented by the formula $La_2W_{1+x}O_{6+3x}$, which corresponds to a solid solution of WO_3 in La_2WO_6. In its crystallography, lanthanum oxytungstate differs significantly from the rest of the rare earth tungstates and molybdates of the $Re_2W(Mo)O_6$ type. The La_2WO_6 crystals can be assigned to the hexagonal system and have a laminar structure associated with their polytypism. The commonest six-layered polytype belongs to the space group $P6_3/mmc$ and the parameters of the unit cell are as follows: $a=9.04\pm0.01$ Å and $c=6C_0=32.60-33.65$ Å depending on the composition of the crystal. Five- and seven-layered polytypes are frequently encountered. The crystals are transparent in the visible region of the spectrum, optically uniaxial, and have a high refractive index. (auth)

17653 REFINEMENT OF THE Nd_2O_3 STRUCTURE AND DETERMINATION OF THE NEUTRON SCATTERING LENGTH OF NEODYMIUM. Boucherle, J. X. (CEA Centre d'Etudes Nucleaires de Grenoble, 38 (France)); Schweizer, J. (Institut Max von Laue—Paul Langevin, 38—Grenoble (France)). Acta Crystallogr., Sect. B; 31: No. 11, 2745-2746(15 Nov 1975).

The scattering length of neodymium was redetermined from two independent measurements: one from a neutron powder pattern of Nd_2O_3 which was analyzed by the profile analysis technique and other from the data collected both with polarized and unpolarized neutrons on an $NdAl_2$ single crystal. The two experiments are in good agreement and yield the value $b_{Nd} = 0.769 \pm 0.005\ 10^{-12}$cm. In the course of this study Nd_2O_3 has been confirmed to belong to the space group P3m1 according to the Pauling model. (NL)

17654 PREPARATION AND PROPERTIES OF MULTIFILAMENT NIOBIUM CARBONITRIDE SUPERCONDUCTOR. Smith, W. D.; Lin, R. Y.; Coppola, J. A.; Economy, J. (Carborundum Co., Niagara Falls, NY). IEEE Trans. Magn.; MAG-11: No. 2, 182-184(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois USA (30 Sep 1974). See CONF-740957-.

Fine diameter multifilament yarn was prepared by chemical conversion of a precursor carbon yarn. The fibers are generally composed of both NbC and NbCN phases and exhibit a T/sub c/ of 16-17.5°K and an H/sub c2/ of 110-120 kG. I/sub c/ values at zero field of up to 130 amperes have been measured corresponding to a J/sub c/ of 10^6 A/cm^2. I/sub c/ is proportional to the amount of superconductor phase present as judged by weight gain data. At low conversion levels an anomaly has been detected in critical current behavior of the fibers suggesting a noncontinuous superconducting path. Electrical contact to the fibers by copper coating is discussed showing the importance of obtaining a low resistance contact. J/sub c/ was measured as a function of magnetic field for both the pure material and samples doped with silicon using $SiCl_4$. The silicon dopant was found to be effective in reducing the field dependence of the critical current. (auth)

17655 ELECTRODEPOSITION OF ZIRCONIUM DIBORIDE FROM OXIDES DISSOLVED IN MOLTEN CRYOLITE. Fracer, E. J.; Anthony, K. E.; Welch, B. J. (Univ. of New South Wales, Kensington, Australia). Electrodeposition Surface Treat.; 3: No. 3, 169-177(May 1975).

Zirconium diboride has been deposited from B_2O_3 and ZrO_2 dissolved in molten Na_3AlF_6 using nickel as the cathode material. The mechanism of the deposition and the morphology of the deposit were shown to be strongly dependent upon melt composition and current density. A series of nickel boride diffusion compounds was also identified by electron microprobe analysis. The compounds Ni_3B, Ni_2B, Ni_4B_3 and NiB were formed quite readily at lower current densities. The ZrB_2 deposit was mainly scaly and/or dendritic and was usually non-adherent. Three competing reaction sequences were found to be in operation: boron deposition and nickel boride formation by diffusion; boron deposition and subsequent chemical reaction with ZrO_2 to form ZrB_2; and codeposition of boron and zirconium to form ZrB_2. (auth)

17656 SUPERCONDUCTIVITY AND ANHARMONICITY IN V_3Si. Smith, T. F. (Commonwealth Scientific and Industrial Research Organization, Sydney); Finlayson, T. R.; Shelton, R. N. J. Less-Common Met.; 43: No. 1/2, 21-32(1975).

Measurements of the thermal expansion of a number of A15 structure V—Si compounds containing 22.7 to 26 at.% Si have been made between 1.5°K and room temperature. Compounds with compositions between 25 and 26 at.% Si exhibit a highly-anomalous, negative thermal expansion below ~60°K, the magnitude of which depends strongly upon composition. The pressure dependence of the superconducting transition temperature has also been determined up to 20 kbar and dT_c/dP is found to be relatively independent of the composition. The relationship between dT_c/dP and the expansion behavior is discussed. (auth)

17657 LOW TEMPERATURE THERMAL AND ELECTRICAL PROPERTIES OF CHEMICAL-VAPOR-DEPOSITED Nb_3Ge. Harper, J. M. E. (Stanford Univ., CA); Geballe, T. H.; Newkirk, L. R.; Valencia, F. A. J. Less-Common Met.; 43: No. 1/2, 5-11 (1975).

Heat capacity measurements from 4 to 32°K are presented for chemical-vapor-deposited Nb_3Ge with a superconducting transition temperature of 21.2°K. A search for evidence of a lattice transformation in heat capacity, resistivity, and temperature derivative of resistivity, reveals no anomalies up to 65°K. (auth)

17658 OBSERVATIONS ON Nb_3Si AND THE RELATIVE STABILITY OF A15 VERSUS Ti_3P-TYPE STRUCTURES. Waterstrat, R. M. (Univ., Geneva). J. Less-Common Met.; 43: No. 1/2, 105-115(1975).

A study of the structure, alloying behavior and other properties of the stable compound Nb_3Si suggests that this compound crystallizes in a Ti_3P-type structure rather than in an A15-type structure, primarily because of a strong electrochemical interaction between niobium and silicon atoms. It is suggested that similar interactions may occur in the A15-type compounds such as Nb_3Ge and Nb_3Sn and that these could be responsible for structural instabilities which are relieved by deviations from ideal stoichiometry or by martensitic transformations. (auth)

17659 SUPERCONDUCTING PROPERTIES OF THIN FILM NIOBIUM CARBONITRIDES ON CARBON FIBERS. Pike, G. E. (Sandia Labs., Albuquerque, NM); Mullendore, A. W.; Schirber, J. E.; Napier, J. IEEE Trans. Magn.; MAG-11: No. 2, 185-188 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The characteristics of a new superconducting wire material, consisting of a 7 mu m carbon filament substrate thinly coated with niobium carbonitride, are reported. These filaments are coated (approximately 1000 at a time as a yarn) by a co-CVD process in which the desired carbonitride is deposited as a compound. Several coating compositions from NbC to $NbC_{.75}N_{.15}$ were studied. At each composition several coating thicknesses from 300 to 3000 A were prepared. Although the present coating compositions are not near $NbC_{0.3}N_{0.7}$, which has previously been determined as optimum for this pseudobinary system, we nevertheless have obtained excellent superconducting properties. Zero-field critical current densities of 2×10^6 A/cm^2 in the coating have been obtained, and there is no discernable ac loss at frequencies up to 50 kHz. In addition to the superconducting measurements, chemical x-ray diffraction, and electron microscopic analyses on the coated filaments were also performed. (auth)

17660 IMPROVED SUPERCONDUCTING PROPERTIES OF MULTIFILAMENTARY NIOBIUM CARBONITRIDE WIRE. Ohmer, M. C. (Air Force Materials Lab., Wright-Patterson Air Force Base, OH); Wollan, J. J.; Ho, J. C. IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 159-162(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Transport and magnetization measurements were made on 6 mu, 720 filament niobium carbonitride yarn. The magnetization data is discussed in terms of the hysteretic loss, the temperature dependence of J/sub c/, the matrix-superconductor bond quality and the doping effects on the high field J/sub c/'s. Transport properties are compared to properties obtained from magnetization data. In addition, weak coupling has been investigated in low conversion fibers. The V-I curves show numerous voltage steps, some corresponding to an order of magnitude increase in resistivity. (auth)

17661 ELECTROMECHANICAL RESPONSE OF PZT 65/35 SUBJECTED TO AXIAL SHOCK LOADING. Lysne, P. C.; Bartel, L. C. (Sandia Labs., Albuquerque, NM). J. Appl. Phys.; 46: No. 1, 222-229(Jan 1975).

This theoretical and experimental investigation deals with the electromechanical response of a shock-loaded ferroelectric ceramic material. Quartz gage and voltage-mode techniques were used to characterize the mechanical and electrical responses,

respectively, of PZT 65/35 to approximately 80 kbar. Below approximately 20 kbar the wave propagation was dispersive, whereas step shocks were steady between approximately 20 kbar and the approximately 36-kbar Hugoniot elastic limit. Above 36 kbar the final stress states were reached asymptotically and are believed to be steady. The electrical response was complicated by the ferroelectric-to-paraelectric phase transformation at 60 +- 3 kbar and the kinetics of the change in polarization. To investigate this latter effect, a kinetic model is developed which gives good agreement with experimentally determined voltage responses. (auth)

17662 DIRECT TRANSITIONS AMONG THE ALLOTROPIC FORMS OF BORON NITRIDE AT HIGH PRESSURES AND TEMPERATURES. Corrigan, F. R. (General Electric Co., Worthington, OH); Bundy, F. P. J. Chem. Phys.; 63: No. 9, 3812-3820 (1 Nov 1975).

The direct transition behavior among the graphitic (hBN), wurtzitic (wBN), and zincblende (zBN) crystal forms of boron nitride is investigated as a function of temperature for pressures up to 130 kbar. At pressures in the 45 to 70 kbar range, direct transformation of both the hBN and wBN forms to the zincblende form are observed and at higher pressures (85 kbar and above) direct transformation of hBN to wBN is also observed. A pressure/temperature phase diagram is presented for pressures up to 130 kbar. In this pressure range, the thermodynamically stable solid phases are hBN and zBN, the experimental behavior indicating that wBN is not thermodynamically stable over this range. From temperature/time data, the activation energy for both the hBN to zBN and wBN to zBN transitions is estimated to be about 200 kcal/mole. From these high activation energies it is concluded that the direct conversion processes essentially require disruption of the hBN and wBN lattices before the atoms can re-form into the zincblende structure. (auth)

17663 ELECTRIC ENERGY GENERATION BY SHOCK COMPRESSION OF FERROELECTRIC CERAMICS: NORMAL-MODE RESPONSE OF PZT 95/5. Lysne, P. C.; Percival, C. M. (Sandia Labs., Albuquerque, NM). J. Appl. Phys.; 46: No. 4, 1519-1525 (Apr 1975).

Reproducible and predictable electrical pulses with peak powers of a few hundred kilowatts lasting for a few microseconds can be obtained from shock-wave compressed ferroelectrics. Impact-loading techniques are used to investigate the electromechanical response of poled specimens of a ferroelectric ceramic, PZT 95/5, to long-duration shock pulses. The experiments are conducted in the normal mode in which the shock propagation vector is perpendicular to the remanent polarization. Current histories are obtained as a function of load resistance for a fixed shock amplitude of 1.4 GPa, and few additional experiments investigate the stress dependence of the electrical response. A simple, though specific, model is developed that gives good agreement with observed results. The extension of this model to other materials and shock-loading conditions is discussed. (auth)

17664 DIELECTRIC PROPERTIES OF AMORPHOUS Nb_2O_5 THIN FILMS. Fuschillo, N.; Lalevic, B.; Annamalai, N. K. (Rutgers—the State Univ., New Brunswick, NJ). Thin Solid Films; 30: No. 1, 145-154(Nov 1975).

The dielectric constant, ac resistance, and loss tangent tan delta of amorphous Nb_2O_5 films with Nb electrodes were investigated in the frequency range 3 to 5 x 10^6 Hz as a function of temperature and applied field. The capacitance decreases with frequency f according to a C(f) varies as $f^{-0.3}$ relation in the range 3 Hz less than f less than 800 Hz and remains constant for 800 Hz less than f less than 5 x 10^6 Hz, giving a dielectric constant epsilon/sub r/ of approximately 45. The loss tangent tan delta decreases with f for 3 Hz less than f less than 200 Hz and then forms a loss peak centered at 200 Hz and decreases to a constant value of tan delta approximately equal to 0.05 for f greater than 2 x 10^5 Hz. The activation energy of a dielectric oscillator is 0.032 eV; C–V, G–V, and tan delta–V data are presented. The real and imaginary parts of the complex dielectric constant epsilon* equals epsilon' - j epsilon" and polarizability alpha* equals alpha' - j alpha" were calculated from the data. The Cole–Cole (epsilon" versus epsilon'), Scaife (alpha" versus alpha') and tan delta versus log f plots indicate the existence of two relaxation times below 8 x 10^3 Hz. The films are in a thickness range where the principal conduction mechanism is hopping conduction, as shown by the sigma(f) varies as f" relation, with 0.75 less than n less than 1 behavior at low fields for 8 x 10^3 Hz less than f less than 5 x 10^6 Hz. (auth)

17665 ELECTRONIC STRUCTURE OF A MIXED VALENCE SYSTEM: Eu_3O_4. Batlogg, B.; Kaldis, E.; Schlegel, A.; Wachter, P. (Eidgenoessische Technische Hochschule, Zurich). Phys. Rev.: 12B: No. 9, 3940-3947(1 Nov 1975).

Optical reflectivity of single crystals of Eu_3O_4 was investigated in the photon energy range between 0.03 and 12 eV. Dielectric functions were derived by means of a Kramers–Kronig analysis and interpreted with lattice vibrations and interband transitions from initial Eu^{2+}, Eu^{3+}, and $2p^6$ states into crystal-field-split 5d bands. In addition, intra $4f^6$ transitions were observed and commented on. The Coulomb correlation energy between Eu^{2+} and Eu^{3+} was found experimentally. Optical transmission measurements at low temperatures revealed a blue shift of the absorption edge for temperatures above the Neel point T/sub N/ and in zero external magnetic fields and a red shift of the absorption edge for magnetic fields larger than a critical field H/sub c/ equals 2.4 kOe, confirming the metamagnetic phase. T/sub N/ is found to be 5.2 +- 0.2°K. (auth)

17666 FAR-INFRARED EPR OF Al_2O_3:Mn^{3+} AND gamma-IRRADIATED RUBY. Aurbach, R. L.; Richards, P. L. (Univ. of California, Berkeley). Phys. Rev., B; 12: No. 7, 2588-2595 (1 Oct 1975).

The far-infrared spectra of four samples of Mn-doped Al_2O_3 were measured in the frequency range from 3 to 30 cm^{-1} in applied magnetic fields up to 55 kG using the techniques of Fourier-transform spectroscopy. Several absorption lines, which are attributed to Mn^{3+} ions, were observed for fields oriented both parallel and perpendicular to the c axis. Polarization measurements established that the lines were due to electric dipole transitions. The temperature dependence of the lines was studied in the range from 1.3 to 20°K. Both ground- and excited-state transitions were studied. The ground state was found to be a singlet. Ground-state transition intensities were found to be magnetic field dependent. A crystal-field theory was developed which successfully describes the low-lying states. The Jahn-Teller interaction, which is known to be important for this ion, is included in the theory only in the approximation that its effect is to quench the strengths of various terms in the Hamiltonian. The empirically determined trigonal field and spin-orbit quenching parameters are approximately 0.6 and 0.1, respectively. Excellent agreement with experiment was obtained for the ground-state transitions. The less good agreement obtained for excited-state transitions reveals weaknesses in the model. A gamma-irradiated ruby was also studied and very weak absorption lines believed due to Cr^{2+} and Cr^{4+} were observed. (auth)

Metals and Alloys

17667 PLUTONIUM-DOKUMENTATION, TRANSPLUTONIUM-ELEMENTE, BAND 9, HEFT 1-6. Referate-Zeitschrift. Halbjahresregister 1975. (Plutonium-Documentation, Transplutonium-Elements, Volume 9, No. 1-6. Abstract Journal. Annual Index, 1975). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1975). vp. (In German and English)

17668 PLUTONIUM-DOKUMENTATION, TRANSPLUTONIUM-ELEMENTE, BAND 9, HEFT 7, JULI 1975. Referate-Zeitschrift, 152 Referate (Register-Nr. 2377-2617), 67 Referate (Register-Nr. 466T-546T). (Plutonium-Documentation, Transplutonium-Elements, Volume 9, No. 7, July 1975. Abstract Journal, 152 Abstracts (Register-No. 2377-2617), 81 Abstracts (Register-No. 466T-546T)). Karlsruhe, Ger.; Gesellschaft fuer Kernforschung mbH (1975). vp. (In German and English)

17669 STATUS REVIEW OF ALLOY 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975). 371p.

From proceedings of a British Nuclear Energy Society Conference; Reading, Eng. (25 Sep 1974).

Twenty-eight papers were presented in sessions as follows: general introduction; metallurgical and environmental effects on corrosion and cracking behavior in water and steam; the behavior of Alloy 800 in HTR atmospheres (impure helium); a review of the behavior of Alloy 800 in liquid sodium; mechanical properties and design codes; and fabrication and applications. The Proceedings are prefaced by an Introduction and Summary by the Editor. All the papers (including the Introduction and Summary) were in NSA Scope and separate abstracts were prepared for them. (UK)

Corrosion and Erosion

Refer also to abstracts 16646, 17620, 17710, 17712, 19470, 19488, and 19594.

17670 TANTALUM PROTECTS PUMPS FROM HOT AMMONIATED PHOSPHORIC ACID. Dana, B. P.; Gaines, A. (Tennessee Valley Authority, Muscle Shoals, AL). Chem. Process. (Chicago); 38: No. 13, 24-25(Dec 1975).

For the fabrication of ammonium polyphosphate fertilizers, concentrated H_3PO_4 was replaced by merchant-grade acid containing 54 percent P_2O_5. Because of the abrasive impurities in the merchant-grade acid, fluoropolymer could not be used as protective lining in the pumps of the reactor which is operated near 300°F. Instead, the centrifugal pumps were fabricated from Type 316 stainless steel and plated with 15-mil tantalum. Other components, such as fittings, valves, etc. were lined with TFE. The facility has been in operation for almost 2 years without chemical attack. (DLC)

17671 HYDRIDE FORMATIONS IN ZIRCALOY. Arroyo, J.; Calvo, C. Rev. Metal. (Madrid); 10: No. 5, 319-323(1974). (In Spanish).

Disks 3 mm thick and tubes of 0.57 mm wall thickness in Zircaloy-2 were treated in an autoclave at 360°C in H_2O containing LiOH for various times. Metallography and gas analysis were used to determine the thickness of the oxide film as well as the internal H concentration. The results of various examinations are compared and anomalies noted. (Metals Abstr.)

17672 REACTION OF HYDROGEN WITH SOLUTIONS OF METALS IN LIQUID SODIUM. Hobdell, M. R.; Whittingham, A. C. (Central Electricity Generating Board, Berkeley, Eng.). J. Chem. Soc. (London), Dalton Trans.; No. 15, 1591-1594(1975).

The reaction rate of hydrogen with solutions of lithium (0 to 8.6), barium (0 to 6.1), strontium (0 to 4.0), and mercury (0 to 50 atom%) in liquid sodium is directly proportional to hydrogen pressure (0 to 35 kN m^{-2}) in the temperature range 390 to 565°K under conditions that solution composition and liquid-metal surface area remain effectively constant throughout reaction. Hydrogen reacts more rapidly with solutions containing respectively Li, Sr, and Ba than with pure Na; the reaction with Na-Hg solutions, however, is less rapid. The observed changes in the absolute rate constants, k_r, with solute metal concentration cannot be accounted for solely on the basis of measured activation-energy changes; the pre-exponential factor varies with both the solute metal and its concentration. The results are discussed with reference to possible changes in the energy profiles of conduction-band electrons in the liquid-sodium solutions. (auth)

17673 DEVELOPMENT OF HIGHER-STRENGTH H_2S-RESISTANT STEELS FOR OIL FIELD APPLICATIONS. Grobner, P. J.; Sponseller, D. L.; Cias, W. W. Mater. Performance; 14: No. 6, 35-43(Jun 1975).

Modification of SAE 4130 and 4135 steels were prepared and evaluated in an attempt to improve the yield strength of steels for oil well drill pipe, casing and tool joints, without impairing their resistance to H_2S stress corrosion cracking. Results show that modified steels with increased Mo content, especially in the presence of Nb, when tempered to the same strength level as the standard SAE steels, have markedly improved sulfide stress cracking resistance. (Metals Abstr.)

17674 HIGH-TEMPERATURE OXIDATION OF ALLOYS OF HAFNIUM WITH COBALT. Voitovich, R. F.; Golovko, E. I.; D'yakonova, L. V. Izv. Akad. Nauk SSSR, Met.; No. 3, 204-210 (1975). (In Russian).

The high-temperature oxidation of a series of Hf–Co alloys was studied at 600 to 1200°C in air as a function of composition and mode of preparation. Ranges of concentration were established in which the scaling resistance of the Hf–Co alloys was far greater than that of pure Hf: these were Co 2–50% at 800°C and Co 2–14% at 1000–1200°C. X-ray microanalysis revealed a substantial redistribution of the Co during the oxidation process; the redistribution was due to the diffusion of Co from the scale to the alloy in samples containing up to Co 14%, and to the diffusion of Co from the alloy to the outer phase boundary in those containing higher Co concentrations. (Metals Abstr.)

17675 ELECTRON-DIFFRACTION STUDY OF THE INTERACTION OF THIN CHROMIUM AND YTTRIUM FILMS WITH THE OXYGEN OF THE AIR. Zaitsev, A. A.; Ignatov, D. V.; Korotkov, N. A.; Lazarev, E. M. Izv. Akad. Nauk SSSR, Met.; No. 3, 222-225(1975). (In Russian).

The oxidation of thin Cr–Y films (up to 600 Å thick) in air at 800 to 1400°C was studied by electron diffraction. The principal reaction product identified was $YCrO_3$. Analysis of the electron-diffraction patterns confirmed that the chromite formed under these conditions had a structure of the perovskite type and remained thermodynamically stable when heated over the range indicated. In the course of low-temperature annealing at around 800°C the Cr–Y films containing a high proportion of Y developed two forms of Y_2O_3: one with a cubic lattice (low-temperature form) and another hexagonal (high-temperature). (Metals Abstr.)

17676 GROWTH OF IRON OXIDE FILMS ON CARBON STEEL AND PLATINUM SURFACES IN LiOH AND NaOH SOLUTIONS AT 285°C. Macdonald, D. D.; Rummery, T. E. (Whiteshell Nuclear Research Establishment, Pinawa, Manitoba). Corros. Sci.; 15: No. 9, 521-527(Oct 1975).

The corrosion products formed on carbon steel exposed to 1 mol/l LiOH and NaOH at 285°C in titanium autoclaves have been investigated using scanning electron microscopic and x-ray diffraction techniques. The effect of galvanically coupling the carbon steel to platinum was also studied. In LiOH both Fe_3O_4 and α-$LiFeO_2$ were found to form on the carbon steel surface but only α-$LiFeO_2$ was observed to nucleate on platinum in this solution. In NaOH solution both Fe_3O_4 and $FeTiO_3$ were identified on the metal surface. Galvanic coupling to platinum decreased the amount of α-$LiFeO_2$ and $FeTiO_3$ formed on carbon steel surfaces. (auth)

17677 BACKSCATTERING STUDY AND THEORETICAL INVESTIGATION OF PLANAR CHANNELING PROCESSES. I. EXPERIMENTAL RESULTS. Abel, F.; Amsel, G.; Bruneaux, M.; Cohen, C.; L'Hoir, A. (Groupe de Physique des Solides de l'Ecole Normale Supérieure, Tour 23, 2 Place Jussieu, 75221 Paris Cedex 05, France). Phys. Rev. B 12: No. 11, 4617-4627 (1 Dec 1975).

Backscattering experiments in planar channeling have been performed on iron single crystals with 1.9-MeV ^4He beams; these conditions having been chosen for optimal study of the structure of the spectra. Both for the (110) and (100) planes five equally spaced yield maxima are clearly resolved, the maxima damping out at lower energies. Spectra were also registered at various angles of incidence φ_0 with respect to the planes. Yield maxima are observed up to values of φ_0 twice the half-width at half-minimum $\psi_{1/2}$ of an angular scan across the plane [$\psi_{1/2}=1.8°$ for the (110) plane]. Except for the first two peaks, these maxima have the same spacing as in the aligned spectrum. They appear to be due to particles belonging to a well-defined transverse energy interval. The mean stopping power for these particles is close to the random stopping power and the mean half-wavelength of their oscillating trajectories in the planar channels calculated from the results is $\lambda=380$ Å for the (110) plane and $\lambda=320$ Å for the (100) plane. For $\varphi_0 > 1.2\psi_{1/2}$, the yield on the first maximum is greater than the random yield, reaching ~1.6 times the latter for $1.4\psi_{1/2} < \varphi_0 < 1.8\psi_{1/2}$. The shoulder effect in the angular scans, as observed for various depths, is clearly related to the yield maxima and hence depends strongly on the position and width of the depth interval chosen. The meaning and validity of the assumption of statistical equilibrium for planar channeled particles are discussed in light of the results. (auth)

17678 PHOTOEMISSION FOR Xe PHYSISORBED ON W(100): EVIDENCE FOR SURFACE CRYSTAL-FIELD EFFECTS. Waclawski, B.J.; Herbst, J.F. (National Bureau of Standards, Washington, D.C. 20234). Phys. Rev. Lett. 35: No. 23, 1594-1596 (8 Dec 1975).

Photoemission spectra at $h\nu = 21.2$ eV reveal two $5p$ levels for xenon physisorbed on a tungsten (100) surface. The spin-orbit splitting of the two levels and their intensity ratio correspond closely to gas-phase measurements, while the $5p_{3/2}$ peak is significantly broadened with respect to the $5p_{1/2}$. We interpret the broadened structure as an unresolved doublet resulting from splitting the Xe $5p_{3/2}$ states in the tungsten-surface crystal field. (auth)

17679 THE SIGNIFICANCE OF THE IRON(III) IONS FOR THE CORROSION DANGER IN CLEANING STEAM GENERATORS. Bursik, A. Stuttgart; Stuttgart Univ. (1972). 79p. (In German). INIS.

Thesis.

The pickling of plant components and the chemical cleaning of steam boilers are discussed. The danger of corrosion with chemical cleaning of steam boilers and salt or hydrofluoric acid is indicated. By dissolving the Fe(III)-containing surfaces, Fe(III) ions are produced which react with the base metal and form Fe(II) ions. The corrosion losses caused by this reaction are considerably higher than those caused by a direct acid effect from inhibited acids. Many common acid inhibitors are not stable to iron(III) compounds. This is particularly true for hydrofluoric acid inhibitors. The corrosion due to iron(III) ions cannot only be reduced but even inhibited by suitable additions to the cleaning solution. In the case of hydrochloric acid, the often recommended addition of fluorides was not successful. Tin(II) chloride proved to be the most effective of all investigated additives. The addition of thioglycalic acid to an iron(III)-containing hydrofluoric acid inhibited the corrosion through the iron(III) ions and thus simultaneously also the decomposition of the inhibitor. The corrosion loss of 10 – 20 g/m^2 during a boiler cleaning, as is mostly allowed by the boiler operators, can be technically suppressed by using effective additives even with the presence of iron(III)-containing coatings. (DE)

17680 THE REACTIONS OF SOLIDS AND THEIR KINETICS IN THE FORMATION OF SILICIDE COATINGS ON TRANSITION METALS OF THE FIFTH AND SIXTH GROUP AND IN THEIR HIGH

TEMPERATURE OXIDATION REGARDING OXIDATION PROTECTION OF NIOBIUM. Schmidt, F. K. Karlsruhe, Ger.; Karlsruhe Univ. (1973). 157p. (In German). INIS.

Thesis.

The reactions controlled by diffusion processes in the solid state in the formation of silicide coatings on niobium and the high temperature oxidation of these through gaseous oxygen were studied. A comparative thermodynamic consideration on the high-melting Me_5Si_3 and $MeSi_2$ silicides of the transition metals of the fifth and sixth group (Nb,Ta,Mo,W) leads to a combination of the latest and most probable ΔG and ΔH values for the reactions of formation. Besides the latest literature data (1972) a method for the estimation of the experimentally determined melting temperatures is also developed. Kinetic studies were made on the siliconizing and silicide decomposition reactions in the solid state. Layer growth constants and diffusion coefficients as well as their temperature dependence are given. The diffusion pairing $MoSi_2$/Nb is especially studied due to their technical interest. The subordinate metal exchange diffusion is quantitatively described and the influence of various silicon activities on the Me_5Si_3 layer growth is shown. The suitability of Nb_5Si_3 as diffusion barrier with an attenuation factor of about 3 compared to Mo_5Si_3 is described and the oxidation kinetics of $NbSi_2$ on Nb quantitatively studied. (DE)

17681 METAL LOSSES DURING ANNEALING OF TUNGSTEN IN OXYGEN, AIR, AND WATER VAPOR AT HIGH TEMPERATURES AND LOW PRESSURES. Jehn, H.; Fromm, E. (Max-Planck-Institut fuer Metallforschung, Stuttgart). J. Less-Common Met.; 43: No. 1/2, 217-224(1975). (In German)

The evaporation rates of tungsten in oxygen, air, and water vapor have been determined gravimetrically in the temperature range 1400 to 2400°C and over the pressure range 1×10^{-4} to 5×10^{-3} torr. In the presence of oxygen-containing gases the metal losses are strongly increased through the formation of volatile oxides. The temperature dependence observed is consistent with results obtained in mass spectrometric investigations. (auth)

17682 CHANGE OF ELECTROTRANSPORT-DIRECTION WITH INCREASING TEMPERATURE IN THE NIOBIUM–OXYGEN SYSTEM. Fromm, E.; Kirchheim, R.; Mathuni, J. (Max-Planck-Institut fuer Metallforschung, Stuttgart). J. Less-Common Met.; 43: No. 1/2, 211-215(1975).

The effective charge Z^+ of oxygen in niobium was measured from 1500 to 2400°K at an oxygen content of 0.5 at.%. A reversal of the sign of Z^+ was found at 2100°K, where for lower temperatures Z^+ is positive corresponding to a migration of oxygen towards the cathode while at higher temperatures oxygen is driven towards the anode ($Z^+ < 0$). The results are discussed by assuming that electron- and hole-interaction with the interstitial oxygen atoms play the dominant role. (auth)

17683 POTENTIAL AND CHLORIDE EFFECTS IN THE STRESS CORROSION CRACKING OF TYPE 304 STAINLESS STEEL IN 290°C WATER. Jones, R. L. (Naval Research Lab., Washington, DC). Corrosion; 31: No. 12, 424-431(Dec 1975).

The stress corrosion cracking (SCC) of stainless steel in high temperature water was studied by anodically polarizing stressed (partially flattened), hollow thinwall Type 304 stainless steel electrodes to the point of SCC in 0.001N to 5N NaCl at 290°C. The potential of SCC increased progressively as the chloride concentration was lowered, cracking occurring at about 600 mV (with respect to Pt) with 5N NaCl, but not until about 1100 mV with 0.001N NaCl. On the other hand, SCC was always preceded by pitting where the current rose sharply, and the current required to produce cracking was progressively less as the NaCl concentration decreased. There was no rise in hydrogen flux through the electrode wall prior to cracking, nor any other indication of a hydrogen effect in SCC. The pitting preceding SCC was revealed by SEM to actually involve a type of filiform corrosion where chloride was concentrated under the surface oxide in filament-like occluded cells. A Cr-rich corrosion phase is formed beneath these cells, and it is within this phase that SCC apparently initiates. With 5N NaCl, a thin, amorphous electrobrightening surface film formed in place of the crystalline spinel film which developed with lower concentrations. SCC appeared to initiate through filiform corrosion in this film also, however. (auth)

17684 USE OF ANODIC POLARIZATION IN FUSED Na_2SO_4 FOR ESTIMATING HOT CORROSION RATES. Shores, D. A. (General Electric Co., Schenectady, NY). Corrosion; 31: No. 12, 434-440(Dec 1975).

A technique based on potentiokinetic anodic polarization in fused Na_2SO_4 was developed for the purpose of estimating the hot corrosion resistance of Ni- and Co-base superalloys. Because it is relatively fast, this technique was used to preliminarily identify promising candidate alloys, which may then be further evaluated in a conventional burner rig apparatus. An empirical correlation was established between values of log i/sub corr/ from the electrochemical test and penetration rates from the burner rig test. In a further use of the electrochemical test, corrosion rates of IN-738 were determined in several Na_2SO_4 melts which encompassed a range of acidities. Both basic and acidic melts produced considerably higher corrosion rates than were found in neutral (reagent grade) salt. (auth)

17685 SUSCEPTIBILITY OF IRON- AND NICKEL-BASE ALLOYS TO SCC IN pH 2.5 H_2SO_4 AT 289C. Vermilyea, D. A. (General Electric Co., Schenectady, NY). Corrosion; 31: No. 12, 421-423(Dec 1975).

A straining electrode test was used to determine the relative susceptibilities of various alloys to stress corrosion cracking (SCC) in a high temperature aqueous solution. Results showed that duplex alloys are generally superior to austenitic alloys, and that nickel-base alloys have the greatest resistance except in the sensitized condition. (auth)

Preparation and Fabrication

Refer also to abstracts 16888, 17007, 17103, and 17820.

17686 (AED-CONF-75-170-012) THE BEHAVIOUR OF DOPED ELEMENTS IN TUNGSTEN SINTERING. Scheiner, L. 1975. 4p. (In German). INIS.

From general meeting of the Deutsche Gesellschaft fuer Metallkunde; Nuernberg, F. R. Germany (20 May 1975).

The lecture deals with the occurrence of bubbles in the sintering of doped tungsten. The doping of tungsten normally takes place by the addition of K, Al and Si compounds. A part of the doping substances disappears with sintering. This can easily be proved by chemical analyses. In the process described here, the evaporation is non-destructively observed during sintering with an absorption spectrometer. Temperature, absorption slope and sintering resistance are recorded. The evaluation of the absorption curves gives a diffusion equation. The discussion of the curves resulted so far in that a doped substance compound sets free the single elements of the compound at high temperature. Aluminium and silicon diffuse out. In the case of aluminium, the activation energy can be determined. (DE)

17687 (CNLM-3087) CNLM-3087, NOVEMBER 4, 1960 (REPORT). (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 4 Nov 1960. 6p. Dep. NTIS $3.50.

Declassified 12 Jan 1976.

A proposal is presented concerning design of a very compact NaK-to-air radiator matrix design using heat resisting alloys for inclusion in an engine of small diameter for use in aircraft with low frontal area requirements. The design of compact high performance liquid metal-to-air radiators demands the incorporation of superior extended surfaces to increase the heat transfer capabilities of a unit volume of the matrix. A design concept being studied incorporates large flattened tubes to form each liquid metal pass in the radiator. Continuous ribbon extended surfaces are to be brazed or welded to the flattened tubes to yield a high density matrix. (auth)

17688 (FRNC-TH-559) INTERACTION OF A LASER BEAM WITH A TARGET. Application to the Fabrication of Granular Superconducting Films. Desserre, J. (Paris-7 Univ., 75 (France)). 1974. 187p. (In French). INIS.

The aim was to prepare a superconductor of high T(c). The different simplified theories (BCS, Mac Millan) whereby the critical temperature of a superconductor can be calculated, with a view to its optimization are given. A material and a preparation technique were chosen on the basis of these theories. The method uses phenomena that occur during the interaction of a coherent pulsed light beam, emitted by a laser, with the surface of a metallic or nonmetallic target. Different theoretical models of this interaction are proposed. Special attention is paid to complex targets (alloys, compounds) and the construction of a model describing the vaporization of a compound is suggested. By a suitable choice of laser, based on the energy emission profile and the value of the energy supplied, congruent vaporization of the target is possible. The technique was applied to the preparation of thin layers by condensation onto a substrate of the vapor and the plasma emitted during the interaction. The deposits generally have the same structure as the bulk compound used as target while the atomic composition of the film may be slightly different. Thin layers of Ni_3Mn, CdTe, ZnC, HfC were prepared in this way without treatment of the deposits after condensation. Simultaneous vaporization of the compound $ReBe_{22}$ in the bulk state gave filaments made up of small grains (20Å), identical in composition with the target. The beryllium α phase (compact

hexagonal) was identified but the electron diffraction study showed the existence of several other phases of unknown structure. The superconducting properties changed with time. (FR)

17689 PROCEEDINGS OF 1974 NATIONAL POWDER METALLURGY CONFERENCE HELD AT BOSTON, MASSACHUSETTS, APRIL 9–10, 1974. Halter, R. F. (ed.). Progress in Powder Metallurgy, Volume 30. Princeton, NJ; Metal Powder Industries Federation (1974). 213p. (CONF-7404117-). $35.00.

Papers given at the conference on process variables in production of P/M parts, properties of 316L steel powder, compacts, properties of highly porous Al powder compacts, properties of Cu infiltrated steel powders, uses of P/M Ti and P/M Al alloys, heat treatment of P/M parts, quality control, safety, ultrasonic testing of P/M parts, P/M sealing, cold pressing P/M, properties of AISI 4027 P/M materials, properties of Ni–Mo steel powders, and state of the industry-1974 are presented. (JRD)

17690 CORROSION BEHAVIOR OF ZIRCONIUM–NIOBIUM–BERYLLIUM ALLOYS IN WATER AND STEAM AT HIGH TEMPERATURES. Tank, R. N.; Gadiyar, H. S.; Nayar, P. K. K. Trans. Indian Inst. Met.; 27: No. 4, 254-255(Aug 1974).

Specimens of Zr–1% Nb alloys containing Be 0.1, 0.3, or 0.5 wt -% were exposed to (i) steam at 550°C and 1 atm, (ii) steam at 400°C and 1 atm, and (iii) water at 360°C and saturation pressure. The corrosion resistance increased with the Be content. This is ascribed to the pinning of interstitial impurities such as N and O by Be atoms. (Metals Abstr.)

17691 APPLICATION OF LIQUID–LIQUID EXTRACTION PROCESSES IN HYDROMETALLURGY. Ziegenbalg, S. Neue Huette; 20: No. 3, 181-189(Mar 1975). (In German)

A short discussion of the theory of liquid–liquid extraction precedes a description of the various types of plants developed for its large-scale application and of certain cases in which the plant is used, in particular in V, Mo, Re, Ta, Nb, Cu, and Ni extraction or recovery. (Metals Abstr.)

17692 SIMPLE METHOD FOR THE PREPARATION OF HOLLOW WIRES FROM SOFT METALS. Posada, E.; Robin, D.; Rinderer, L. (Univ., Lausanne, Switzerland). Cryogenics; 15: No. 8, 482-483(Aug 1975).

A method is described of producing thin capillaries of tin, indium, and lead used in experiments on the properties of "mixed state" two-dimensional layers in type 1 superconductors. Wires with outer diameters between 0.3 mm and 0.5 mm and inner diameters between 0.1 mm and 0.4 mm can be fabricated easily. (UK)

17693 PLASTIC ZONE SIZES IN FATIGUE SPECIMENS OF INCO 718. Clavel, M.; Fournier, D.; Pineau, A. (Centre des Materiaux of Ecole des Mines de Paris). Metall. Trans., A; 6A. No. 12, 2305-2307(Dec 1975).

An etching technique is described which can be used for Inco 718. This etching technique is suitable to measure the plastic zone sizes in INCO 718. It is currently being used in a study of the fatigue behavior of this alloy. Since this method is specific to the gamma" yields beta phase transformation it can also be used for INCO 706 which is also strengthened by gamma". The same principle of post-deformation heat-treatment to delineate plastic zones could be used, for instance, in Fe–Ni–Cr–Ti alloys which exhibit a strain-accelerated gamma' yields eta (DO_{24}) transformation. (auth)

17694 MANUFACTURE OF HEAVY STEEL CASTINGS FOR NUCLEAR POWER GENERATION. Makagawa, Y.; Nishimura, Y.; Nakada, S.; Miyamoto, T. Nippon Seiko Giho; No. 36, 49-54 (1975). (In Japanese).

High-quality heavy steel castings for nuclear power generating use are manufactured at the Muroran Plant of the Japan Steel Works. Quality level and manufacturing process of the channel head casting and main pump casing are briefly presented. (Metals Abstr.)

17695 PROIZVODSTVO FERROSPLAVOV. (Manufacture of Iron Alloys). Ryss, M. A. Moscow; Metallurgiya (1975). 336p..

Theoretical bases and practical problems of iron alloy metallurgy are systematized and generalized with consideration of latest industrial achievements and prospects for future development. The book is designed for engineers and designers of the iron alloy industry and metallurgical plants, students, and scientific research and architectural institutes and may be used by students of technical schools specializing in this field. (auth-tr)

17696 PRODUCTION AND FABRICATION OF 2500-LB Nb–Ti INGOTS TO ROD. Cordier, T. E.; McDonald, W. K. (Teledyne Wah Chang, Albany, OR). IEEE Trans. Magn.; MAG-11: No. 2, 280-282(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Interest in Nb–Ti superconducting devices is exploding. This paper outlines the critical production criteria for this material. Areas discussed include ingot blending, melting, forging, extrusion, and rod reducing with emphasis on the metallurgical considerations affecting mechanical properties. Data are included relating process parameters to TEM finding as well as R.T. ductility and optical microscopy. (auth)

17697 MULTIFILAMENTARY NIOBIUM TIN SUPERCONDUCTOR TAPE. Brisbin, P. H. (Intermagnetics General Corp., Guilderland, NY); Coles, W. D. IEEE Trans. Magn.; MAG-11: No. 2, 283-286(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

An effective method for the fabrication of multifilamentary Nb_3Sn tape was developed. Filamentary superconductive paths are produced in otherwise standard commercial superconductor tape by the chemical milling of separator slots through the Nb_3Sn layer. The present multifilament configuration features a matrix of ten parallel helical superconducting paths along the length of the tape; filament width and interfilament separation are approximately 1.2 mm and 0.4 mm respectively. Thirty-five multifilamentary tapes 0.4 m long were produced. Complete arrays of continuous fully defined filaments were reliably formed. Tapes tested as small pancake coils (6 to 10 T) demonstrated the integrity and continuity of the matrix and showed that critical current was sustained in direct proportion to retained superconductor. Interesting behavioral differences resulted from filamentization: critical current anisotropy was reversed, and the slope of the I/sub c/ versus H curve was reduced. Other tests found qualitative evidence of substantially improved stability in the multifilamentary tape. (auth)

17698 MULTIFILAMENTARY Nb_3Sn FOR SUPERCONDUCTING GENERATOR APPLICATIONS. Scanlan, R. M. (General Electric Corporate Research and Development Center, Schenectady, NY); Fietz, W. A. IEEE Trans. Magn.; MAG-11: No. 2, 287-290 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Progress achieved to date of a joint IGC-GE program for developing a practical multifilamentary Nb_3Sn superconductor for use in a superconducting generator is described. The cable approach for producing a Nb_3Sn conductor is evaluated, and the results of bend and tensile tests for various cables are presented. Fabrication methods for producing long lengths of multifilamentary Nb_3Sn superconductor are discussed, and test data for several small coils are presented. (auth)

17699 POTENTIAL FABRICATION METHOD OF SUPERCONDUCTING MULTIFILAMENT WIRES OF THE A-15-TYPE. van Beijnen, C. A. M.; Elen, J. D. (Reactor Centrum Nederland, Petten). IEEE Trans. Magn.; MAG-11: No. 2, 243-246(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A method is described for production of A-15-type multifilament superconductors, based on mechanical size reduction of composites of unalloyed copper with niobium or vanadium cores. These cores are in themselves hollow and filled with fine grain size powder of an intermetallic compound of niobium or vanadium, rich in the second element of the required superconductor. After obtaining the final dimensions of the ductile composite without intermediate heat treatments, metal and intermetallic compounds are converted by heat treatment into the superconductor which is formed as a continuous layer inside the tublets. In particular the preparation is reported of V_3Ga and V_3Si conductors using V_2Ga_5 and VSi_2 powder respectively. Critical current density values of seven filament wire are included, measured at 4.2°K up to 10 T.

17700 VARIATION OF T/sub c/ OF SPUTTERED Nb_3Ge. Ghosh, A. K.; Pendrys, L.; Douglass, D. H. (Univ. of Rochester, NY). IEEE Trans. Magn.; MAG-11: No. 2, 225-226(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Alloy samples of Nb and Ge were prepared by simultaneous rf sputtering of composite Nb–Ge targets onto heated alumina substrates. Variation of the superconducting transition temperature T/sub c/ and the x-ray properties of these specimens were studied as a function of the alloy composition, in the neighborhood of Nb_3Ge. Variation of the sputtering parameters, i.e., the self bias voltage, sputtering gas pressure, and substrate temperature was also studied. Results indicate that high T/sub c/ occur for well-ordered stoichiometric Nb_3Ge alloys. It was also found that the competing tetragonal phases are promoted by the highly energetic atoms, i.e., at high sputtering rates. The relative sticking proba-

bility of Ge is important at the higher substrate temperatures. (auth)

17701 SELECTIVE THERMALIZATION IN SPUTTERING TO PRODUCE HIGH T/sub c/ FILMS. Cadieu, F. J.; Chencinski, N. (Univ. of New York, Flushing). IEEE Trans. Magn.; MAG-11: No. 2, 227-230(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

To understand the sputtering process as a means of producing high T/sub c/ metastable superconducting compounds, the need for thermalization of the sputtered atoms as they are deposited on the substrate was investigated. Low-pressure rf sputtering was used to produce Nb_3Ge with T/sub c/ of approximately 22°K for pressures of 20 m torr Kr and for 45 m torr Ar. To test the hypothesis that a thermalization is required to effect a high T/sub c/ in Nb_3Ge, the sputtering process was studied for systems such as Nb_3Al where Kr is used to thermalize the Nb atoms with the minimum number of collisions and an admixture of Ne is used to optimally thermalize the Al atoms. A computer simulation of the sputtering process aids in the choice of optimum parameters. If the thermalization hypothesis is correct, then coevaporation should be able to produce high-T/sub c/ Nb_3Ge. (auth)

17702 FABRICATION AND PROPERTIES OF Nb_3Sn SUPERCONDUCTORS BY THE SOLID DIFFUSION PROCESS. Suenaga, M.; Sampson, W. B.; Klamut, C. J. (Brookhaven National Lab., Upton, NY). IEEE Trans. Magn.; MAG-11: No. 2, 231-237(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

It has been demonstrated that the superconducting compound Nb_3Sn can be produced at the interface of Nb and a Cu–Sn alloy when the composite is heat treated at the proper reaction temperature. This method of Nb_3Sn preparation was also shown to be particularly suited to the fabrication of (a) Nb_3Sn multifilamentary composite wires for dc and low frequency applications and (b) low ac loss Nb_3Sn tapes for 60 Hz applications. The fabrication method and superconducting properties of Nb_3Sn composite conductors made by this process are reviewed and the metallurgical aspects of the process are discussed. Since practical applications of these composites requires large, high current conductors, methods of producing compound conductors such as cables and braided ribbons which include strengthening and stabilizing components are also discussed and some preliminary results of high current conductors are presented. (auth)

17703 SOLID SOLUTIONS OF NIOBIUM–TIN FOR PREPARING Nb_3Sn SUPERCONDUCTORS. Galligan, J. M.; Tregilgas, J. (Univ. of Connecticut, Storrs). Contract AT(11-1)-2305. IEEE Trans. Magn.; MAG-11: No. 2, 238-239(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Solid solution alloys of niobium with concentrations of Sn from 1 to 9 wt percent were prepared by quenching the solid solution from about 2100°C to room temperature. These materials are relatively ductile and can be deformed, by swaging, into the desired shape, after which the material is reacted at about 800°C. The resulting structure is a mixture of Nb_3Sn and Nb, with as much as 45 percent of the volume containing Nb_3Sn. (auth)

17704 IMPROVED J/sub c/ IN MECHANICALLY FABRICATED Nb_3Al WIRES AND RIBBONS. Eagar, T. W.; Rose, R. M. (Massachusetts Inst. of Tech., Cambridge). IEEE Trans. Magn.; MAG-11: No. 2, 214-216(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Nb_3Al wire which is essentially all A15 may be fabricated by powder or rod composite techniques, with subsequent reaction and ordering anneals. Several of the previously existing problems, including aluminum loss and Kirkendall porosity, have been identified and solved, and transverse-field critical current densities well into the 10^5 A/cm^2 range can be produced. However, reproducibility of the critical current density seems to depend on reproducible control of grain size. The internal oxidation techniques which succeed for Nb_3Sn do not appear to work for Nb_3Al. A possible solution to the grain size problem, and to the problem of manufacture of Nb_3Al in stabilized form, is to lower the initial reaction temperature. To achieve the latter, the scale of the elemental composite was reduced to a required diffusion distance of about 3000 A before reaction. Substantial quantities of A15 could be produced at 1100°C, but for several reasons it is believed finer composites will be necessary.

17705 HIGH-RATE SPUTTERING OF Nb–Al–Ge AND Nb–Al SUPERCONDUCTORS. Dahlgren, S. D. (Battelle Pacific Labs., Richland, WA). IEEE Trans. Magn.; MAG-11: No. 2, 217-220 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

High quality Nb–Al–Ge and Nb–Al superconductor deposits, up to 1 mm thick, were made at a rate of 1 mu m/min using high-rate sputtering techniques. High-rate sputtering eliminates most of the fabrication problems generally encountered with these materials. Reasonable quantities of high-field superconductors can be made at acceptable cost for practical applications by high-rate sputtering. Highly reflective metallic mirror surfaces on these deposits indicate a high quality, even in thicknesses up to 1 mm. The deposits were completely free of voids and they did not seem to be overly brittle either before or after heat treatment. Crystal structures for deposits made at 20°C were probably bcc. Heat treatment between 550 and 850°C completely transformed the bcc deposits to extremely small (350 A) grains of the A-15 crystal structure. The A-15 phase formed by heat treatment for 1 h to 5 days at 750°C was metastable and supersaturated with Al and Ge. Deposition and heat conditions for decomposition of the metastable A-15 phase were identified. The highest critical temperatures (18°K) were observed only in those deposits containing undecomposed metastable A-15 phase. To assess practical use of the sputtered superconductors, 1- to 2-m lengths of ribbon and filamentary Nb–Al–Ge superconductor were produced on ribbon and wire substrates. It also was found that an excellent superconductor-stabilizer bond can be formed by high-rate sputter deposition of copper stabilizer onto heat-treated Nb–Al–Ge and Nb–Al superconductors. (auth)

17706 ELECTRON BEAM EVAPORATION SYNTHESIS OF A15 SUPERCONDUCTING COMPOUNDS: ACCOMPLISHMENTS AND PROSPECTS. Hammond, R. H. (Stanford Univ., CA). IEEE Trans. Magn.; MAG-11: No. 2, 201-207(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Accomplishments and prospects of forming A15 superconductors using electron beam evaporation are reviewed. Techniques of monitoring and controlling the evaporation are discussed. The special advantages to the synthesis of A15 materials are pointed out, followed by a number of examples. The prospect of the large scale production of A15 superconductors using electron beam processing is also considered. (auth)

17707 MICROSTRUCTURAL CONTROL OF THIN-FILM DIFFUSION-BRAZED TITANIUM. Wells, R. R. (Aircraft Div. of Northrop Corp., Hawthorne, CA). Weld. J. (N.Y.); 55: No. 1, 20-27(Jan 1976).

This study was designed to determine what parameters should be controlled to achieve quality joints of good toughness and high strength in titanium alloys. Emphasis was placed upon studying those parameters which provided tough joints compatible with the titanium base metal being joined. This paper is concerned with thin-film diffusion brazing based upon the eutectic system formed between copper and titanium. In order to control the joint microstructure, the copper diffusion rates and the beta-phase decomposition kinetics were studied. This information was used to produce various types of microstructures in test specimens. These were then evaluated to select the best microstructures for toughness and strength which were compatible with the titanium alloys. Results show that it is possible to accurately control properties of joints produced by thin-film diffusion brazing. This is done by controlling the initial copper content and the time-temperature parameters used in processing. Alloys studied were Ti–8Al–1Mo–1V and Ti–6Al–4V. (auth)

17708 DEPOSITION RATE OF METALLIC THIN FILMS IN THE REACTIVE SPUTTERING PROCESS. Abe, T.; Yamashina, T. (Hokkaido Univ., Sapporo). Thin Solid Films; 30: No. 1, 19-27 (Nov 1975).

A model is presented giving the deposition rate during the reactive sputtering of metals in atmospheres of oxygen and nitrogen in an argon plasma. On the basis of the difference between the sputtering rates of the metal and its compound, the surface coverage, the sticking probability, and the incident flux of reactive gas atoms, a semi-empirical equation was derived. Computer calculations were made to determine the specific constant values for several reactive sputtering processes such as Mo–O_2, Mo–N_2, Ti–O_2, and Ti–N_2. In each experimental observation, an abrupt decrease of the sputtering rate was found at a particular pressure of reactive gas. The model might be applied successfully for sputtering processes over a wide pressure range of the reactive gas. (auth)

17709 DEOXIDATION THERMODYNAMICS OF CERIUM AND LANTHANUM IN LIQUID IRON. Vahed, A.; Kay, D. A. R. Metall. Trans.; 6B: No. 2, 285-287(Jun 1975).

The deoxidation thermodynamics of the Fe–Ce–O and Fe–La–O systems are estimated by combining the free energies of solution of Ce and La in Fe, obtained from the respective phase

diagrams, with the standard free energies of formation of cerium and lanthanum oxides given in the literature. Values for the deoxidation constants are predicted at steelmaking temperatures. These predicted values are much lower than those obtained experimentally. It is suggested that refractory interactions, and sampling and analytical difficulties, in both laboratory and industrial determinations of these deoxidation constants, lead to erroneously high results. (Metals Abstr.)

17710 ELECTRODEPOSITION OF ALLOYS. III. Electrodeposition and X-Ray Structure of Cobalt–Indium Alloys (Initial Studies). Sadana, Y. M.; Keskinen, A. E.; Guindon, M. (Laurentian Univ., Sudbury, Ont.). Electrodeposition Surface Treat.; 3: No. 3, 149-157(May 1975).

Cobalt–indium alloys, ranging in composition from 2.0 to 90.6% cobalt, have been electrodeposited from aqueous solutions. The effect of current density on current efficiency and composition of the deposit has been studied. An increase in current density increases the cobalt content of the deposits. Addition of ammonium citrate improves current efficiency. X-ray studies of the annealed deposits indicate the presence of two intermediate phases, $CoIn_3$ and Co_2In_3, both of which are tetragonal. The lattice constants are: $CoIn_3$, a = 8.2195 Å, c = 8.669 Å, c/a = 1.020; Co_3In_2, a = 8.23 Å and c = 10.478 Å, c/a = 1.272. (auth)

17711 USE OF ALLOY 800 IN THE THTR STEAM GENERATOR. Fricker, H. W. (Sulzer Bros. Ltd., Winterthur, Switzerland); Mallen-Herrero, J. pp 349-361 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society; Reading, UK (25 Sep 1974).

In 1972 a consortium consisting of Gebrûder Sulzer A. G., Winterthur and EVT, Energie- und Verfahrenstechnik G.m.b.H., Stuttgart, was awarded the contract by HRB, Hochtemperatur Reaktorbau G.m.b.H., Köln/Mannheim, for the design, manufacture and installation of the 6 steam generator units for the prototype 300 MWe Thorium High Temperature Reactor (THTR) at Schmehausen, Germany. The design and manufacture of the 6 units is done by Sulzer; installation of the units as well as the manufacture of the external pipework and headers is done by EVT. The units are built under semiclean conditions in a special workshop at CCM-Sulzer in Mantes, France. This workshop had been used previously for the manufacture of the steam generators for the nuclear power plants St. Laurent I, II, Vandellos (500 Mwe each) and EL-4 (70 Mwe). The operating conditions and the chemical composition of the materials used, including Alloy 800 are described. Reasons for the choice of Alloy 800 (including corrosion resistance and mechanical properties) are given, and an outline of tube welding and fabrication processes. (auth)

17712 ELECTROPLATING OF CRACK-FREE CORROSION RESISTANT Co–Mo ALLOY COATINGS. Kinh, V. Q.; Chassaing, E.; Saurat, M. (Centre d'Etudes de Chimie Metallurgique, Vitry-sur-Seine, France). Electrodeposition Surface Treat.; 3: No. 3, 205-212(May 1975).

Thick crack-free Co–Mo coatings containing 12 to 18% molybdenum can be electroplated on metal substrates from an aqueous citrate complex bath containing sodium molybdate and a cobalt salt. The deposits have a columnar microstructure and a hardness of about 400 VHN. The internal tensile stress in the deposits is about 5 kg/mm^2, does not change significantly with molybdenum content, but shows a slight decrease when the cathode current density increases. These Co–Mo deposited alloys are well-crystallized supersaturated solid solutions with a close-packed hexagonal structure. The cathodic current efficiencies vary between 60 and 75%, depending on experimental conditions. The resistance to acids, especially concentrated hydrochloric, is excellent. Corrosion behavior of deposits is improved by adequate heat treatment and reaches that of their cast counterparts. (auth)

17713 THE ELECTRONIC GUIDANCE AND BEAM OSCILLATION AND ITS INFLUENCE ON ELECTRON BEAM WELDING. Mayer, R. Stuttgart; Stuttgart Univ. (1972). 140p. (In German). INIS.

Thesis.

The technical joining process of electron beam welding can in some cases be realized by beam guidance along a given path across the stationary workpiece. It is thus possible to weld stationary workpieces. Beam oscillation at a small amplitude and high frequency often improves the welding seam. The criteria of assessment are the overall homogeneity of the welding seam as well as the freedom from pipes. (DE)

17714 BORIDING OF NON-FERROUS METALS. Kunst, H. (DEGUSSA, Durferrit, Hanau, Ger.). J. Less-Common Met.; 43: No. 1/2, 307-316(1975). (In German).

Recent development stages in the boriding of non-ferrous metals are presented. Some of the metals for which boriding promises technical advantages (e.g., Ni, Cr) can be treated with the same boriding components as used in the treatment of steel. Other metals (e.g., W) require a different composition for the boriding medium. Refractory metals can only be borided in vacuum or in an inert gas atmosphere with a specially prepared boriding component. The structure of the boride layers thus produced is discussed. With refractory metals mainly boron-rich phases (the diborides, MeB_2) are formed. This is probably governed by the position of the boron atoms in the lattice. (auth)

Properties, Structure, and Phase Studies

Refer also to abstracts 16822, 17030, 17032–17034, 17044, 17047, 17048, 17055, 17056, 17097, 17296, 17605, 17616, 17617, 17700, 17701, 17888, 18367, 18435, 18717, 18738, 18745, 18747–18754, 19245, and 19510–19512.

17715 (CEA-CONF-3070) SOME METALLURGICAL APPLICATIONS OF A SCANNING ELECTRON MICROSCOPE. Observations and X-ray Microanalysis on Rupture Surfaces and Polished Surfaces. Maillard, A.; Meny, L.; Champigny, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Technologie). 1975. 17p. (In French). INIS.

From colloquium of the French Society of Electron Microscopy; Montreal, Canada (26 May 1975).

The laboratory owns a scanning electron microscope equipped with a solid detector. Some examples of fracture surfaces examined during studies on the fatigue of materials, examples of high enlargement metallography and of X-ray microanalysis on a rupture surface and on a polished surface, and an example of rupture in-service are presented. (FR)

17716 (CNRS-RSA-72-73) SHORT PROGRESS REPORT. October 1972–October 1973. (Centre National de la Recherche Scientifique, 92 – Meudon-Bellevue (France)). [nd]. 199p. (In French). INIS.

Researches carried out in various fields of physics, such as solid-state physics, magnetism and rare earth physics, are presented. (FR)

17717 (FRNC-CONF-125) DETECTION OF THERMAL ANOMALIES UNDER A MAGNETIC FIELD. Bethoux, O.; Bojoly, J.; Chaussy, J. (Centre National de la Recherche Scientifique, 38 – Grenoble (France). Centre de Recherches sur les Tres Basses Temperatures). 1975. 5p. (In French). INIS.

From meeting on calorimetry and thermal analysis; Grenoble, France (22 May 1975).

The purpose of this experiment is the calorimetric detection of a superconducting state-normal state transition of precipitates of a supposed superconducting phase in a matrix itself superconducting. The samples are Pb–In alloys with 2% added sodium. (FR)

17718 (FRNC-CONF-126) MICROCALORIMETRY UNDER OSCILLATING THERMAL CONDITIONS. Manuel, P.; Veyssie, J. J. (Paris-11 Univ., 91 – Orsay (France). Lab. de Physique des Solides; Conservatoire National des Arts et Metiers (CNAM), 75 – Paris (France)). 1975. 12p. (In French). INIS.

From meeting on calorimetry and thermal analysis; Grenoble, France (22 May 1975).

The principle of the calorimetric method under oscillating thermal conditions and the uncertainties due to heat gradients are reviewed. A description of the apparatus and of experiments carried out on Al and on a Ag–Pb–Ag deposit obtained by evaporation is presented. The resolution power is very high, reaching 10^{-11} J/K. (FR)

17719 (ITP-75-26R) NONLOCAL MODEL POTENTIAL AND THE ATOMIC PROPERTIES OF NONTRANSITION METALS. Dutchak, Ya. I.; Yakibchuk, P. N.; Zhovtanetskii, M. I. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 28p. (In Russian). Dep. NTIS (US Sales Only) $4.00.

The nonlocal model potential for nontransition metals proposed is analyzed. By means of this potential, some atomic properties of simple metals (binding energy, effective interionic force constants) are investigated. Good agreement with both results of other authors and experimental data is obtained. (auth)

17720 (KFK-EXT-6/75-2, pp 38-67) THERMODYNAMICS OF HARD MATERIAL-BINDER METAL REACTIONS. Pt. 1. Compilation of Thermodynamic Data of Intermetallic Phases Between Hard Material and Binder Metal. Kleykamp, H. May 1975. (In German).

In structure, preparation and properties of refractory compounds and systems. Second semi-annual report 1974. (Kern-

forschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung; Karlsruhe Univ. (TH) (F. R. Germany). Inst. fuer Werkstoffkunde 2).

The reaction behavior of high-melting carbides with the metals of the iron group (Fe, Co, Ni) is discussed and the thermodynamical data so far known on intermetallic phases are compiled. The compilation is limited to the 30 binary metallic systems between the elements in the IVa, Va and VIa groups of the transition metals and the binder metals of the iron group as well as from the Fe, Co and Ni elements amongst each other. Each binary system has been characterized by the number of intermetallic phases and the boundary solubility in the binder metal. These data are necessary for a calculated determination of the stoichiometric region of high-melting carbides which do not lead to reactions with binder metals. (DE)

17721 (LA-6146-MS) INTERACTION BETWEEN CESIUM AND GRAPHITE FOR USE IN THE STUDY OF SURFACE PHENOMENA. Holian, B. L. (Los Alamos Scientific Lab., N. Mex. (USA)). Oct 1975. 11p. Dep. NTIS $4.00.

Surface diffusion has been hypothesized as the fast mode of an unusual fast-slow, two-mode transport process that has been observed in recent diffusion experiments with cesium in graphite. An interaction potential between a cesium atom and a graphite surface is obtained in order to study this surface diffusion by computer simulation (molecular dynamics method). At low surface coverage, the interaction between cesium atoms can be ignored so that the motion of only one cesium atom need be followed, albeit in a very complicated potential energy surface. Cesium is spontaneously ionized by graphite, so that the interaction of cesium with the graphite surface contains pair-wise Cs^+ - C terms (valence, induction, and dispersion forces) as well as an image-charge model of the bulk electrostatic interaction. All parameters but the strength of the repulsive Cs^+ - C force are obtained by theoretical estimates, while this last parameter is determined by requiring that the adsorption Cs^+ - C bond length be the same as observed in cesium-graphite lamellar compounds. Results indicate that the adsorption energy for a pit in the graphite surface of one to five missing carbon atoms is not greatly increased over that for the perfect surface (the one-atom hole is slightly repulsive compared to the perfect surface). For the hexagonal six-atom pit, the adsorption energy increases dramatically from about 120 kcal/mole for the perfect surface to about 200 kcal/mole and remains essentially constant for larger holes. Results for potential energy barriers to migration indicate that a cesium ion on a perfect graphite surface moves along the surface like a free particle at temperatures above 1000°K. Thus, truly diffusive or random-walk behavior at such temperatures requires the presence of defects in the graphite surface. (auth)

17722 (ORNL-5046, pp 120-135) PHYSICS OF SOLIDS AND MACROMOLECULES. Arakawa, E. T.; Birkhoff, R. D.; Braundmeier, A. J.; Callcott, T. A.; Cox, J. T.; Hamm, R. N.; Inagaki, T.; Juan, S. I.; Wheeler, C. E.; Williams, M. W. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Topics covered include: optical properties of solid sodium and lithium from ellipsometric measurements; coupling of photons and surface plasmons at interfaces of known profile; photoemission from aluminum; electron attenuation lengths in carbon films; optical and dielectric properties of bovine plasma albumin between 2 and 82 eV; optical and dielectric properties of polystyrene between 2 and 82 eV; feasibility studies of monitoring the first wall in ORMAK by optical measurements; and soft x-ray emission from insulators. 18 figures. (GHT)

17723 (SAND-75-8301) COMPARISON OF 9Ni-4Co-0.20C STEEL AND TITANIUM ALLOY PROPERTIES FOR WEIGHT-CRITICAL STRUCTURAL APPLICATIONS. Dawson, D. B. (Sandia Labs., Livermore, Calif. (USA)). Jan 1976. Contract AT(29-1)-789. 52p. Dep. NTIS $4.50.

Titanium alloys are attractive in weight-critical applications requiring high strength, due to their high strength-to-density ratios when compared with steel and aluminum alloys. The mechanical properties of titanium alloys such as Ti-6Al-4V, Ti-6Al-6V-2Sn, Ti-6Al-2Sn-4Zr-6Mo, and several beta alloys are discussed and compared with 9Ni-4Co-0.20C steel. Data is presented for strength, fracture toughness, fatigue properties, stress corrosion cracking behavior, and corrosion resistance. The trade-off in strength vs. toughness, SCC resistance, and weldability of titanium alloys is discussed. Recommendations of specific titanium alloy systems for various required strength levels are made on the basis of these factors. (auth)

17724 (TT-74-58007) EFFECT OF SILICON, IRON, AND BERYLLIUM ON THE RATE OF DIFFUSION OF IRON IN ALUMINUM. Smiryagin, A. P.; Kvurt, O. S. Translated from Tr., Gos. Nauch.-Issled. Proekt. Inst. Splavov Obrab. Tsvet. Metal.; No. 16, 90-115(1957). 24p. (DMDC-14036). NTIS $3.25.

The tracer diffusion coefficient of Fe-59 in pure Al and binary Al alloys containing Si(0.57 to 11.54%), Fe(0.58 to 4.67%), or Be(0.25 to 1.5%) was determined in the temperature range 500 to 600°C. Similar experiments were performed with ternary Al alloys containing Si(0.55 to 1.87) and Fe(0.58 to 0.60%). Interdiffusion experiments were performed with pure Fe and Al and Fe with Al alloys containing Si, Be, and Fe at temperatures of 400 to 600°C and then examined metallographically. (GRA)

17725 TRANSITION RADIATION EFFECTS IN SUPERCONDUCTING GRANULES. Drukier, A. K. (Universite Paris-Sud, Paris); Valette, C.; Waysand, G.; Yuan, L. C. L. Lett. Nuovo Cim.; 14: No. 8, 300-304(25 Oct 1975).

The use of superheated superconducting suspensions of granules as a transition radiation detector is suggested; the flipping threshold of the grains can be adjusted so that the superheated state is not affected by the ionization loss energy, but would be flipped into the normal state by transition radiation. An experiment on this effect was conducted in the 7-GeV electron synchrotron. Suspensions of Sn granules in paraffin wax were used. Not only was the frequency change detected, but also an energy dependence effect of this frequency change. A single grain of Hg was also used, and its flipping was also observed. (DLC)

17726 DECAY PROCESS OF SOLID BCC-SOLUTIONS OF THE SYSTEM TUNGSTEN-RHENIUM. Budagovskii, S. S.; Bikov, V. M.; Gavriliuk, M. I.; Ivaniushkin, E. M.; Rudnev, I. I. (Obninsk State Inst. of Atomic Energy, USSR). Ukr. Fiz. Zh. (Ukr. Ed.); 20: 393-397(Mar 1975). (In Ukrainian).

The structure of the crystal lattice defects of W-Re solid solutions was studied by the method of nuclear gamma-resonance on the impurity nuclei of ^{57}Fe. The regions are established to be formed in the considered alloys near the defects. The electronic structure of the regions differs essentially from that of the solid solution matrix. These regions should be considered as nuclei of new phases rich in rhenium. The electronic structure type of the phases under formation and their quantity are a complex function of the composition and structural state of the alloy. (auth)

17727 KAPITZA CONDUCTANCE OF MOLYBDENUM AND BERYLLIUM BETWEEN 1 AND 2°K. Alnaimi, A. E.; van der Sluijs, J. C. A. (University Coll. of North Wales, Bangor). Cryogenics; 15: No. 9, 509-512(Sep 1975).

Using the same experimental methods as in earlier work, studies have been made of the Kapitza conductance between liquid ^4He and clean surfaces of annealed molybdenum and beryllium samples at temperatures between 1 and 2°K. The conductance of molybdenum at 1.5°K is 75 W m^{-2} K^{-1} and for beryllium 24 W m^{-2} K^{-1}. The respective temperature dependances can be described fairly well by $T^{1.1}$ and $T^{1.2}$. The results for different samples reproduce reasonably well and the general behavior is much the same as for the copper and silver samples studied earlier, though some of the effects are rather small. On one of the beryllium samples the Kapitza conductance was measured as a function of the liquid pressure up to 2.75 atm. No significant dependence was found. (auth)

17728 IMPACT STRENGTH OF NIOBIUM ALLOY WELD SEAMS. Asnis, E. A.; Gurevich, S. M.; Demchenko, A. D.; Nerodenko, M. M.; Rabkina, M. D. (Inst. of Electric Welding, Kiev). Probl. Prochnosti; No. 1, 97-99(Jan 1975). (In Russian)

A study was made of the effect of welding modes and heat treatment on the change in impact strength and constituents of niobium and its alloys (pure Nb, Nb-Zr-C, Nb-W-Mo-Zr, and Nb-W-Mo-Zr-C). It was determined that the impact strength of these alloys was a function of welding rate where the highest values of strength were obtained at a speed of 40 to 60 m/h for the hetero-phase alloys, while a minimum change in impact strength was found in weld seams made from niobium alloys with solid-solution strengthening. By separating impact strength into component elements it was found that the higher welding rates were preferable. Optimum modes of heat treatment for the hetero-phase alloys (Nb-Zr-C and Nb-W-Mo-Zr-C) were a one-hour soak at 1200 and 1200 to 1300°C respectively. (JPRS)

17729 BASAL SLIP IN Mg_3Cd ALLOY SINGLE CRYSTALS. Yoshioka, S.; Nakayama, Y.; Ito, T.; Takada, K. Keikinzoku; 24: No. 7, 265-269(Jul 1974). (In Japanese)

The basal slip in Mg_3Cd single crystals was studied in the disordered and ordered states. The ordered specimens were very brittle and exhibited pronounced serrated plastic flow. Slip lines in the disordered state were straight and uniformly distributed, while in the ordered state they were localized. In the disordered specimens dislocations were arranged as pile-up arrays

on the basal plane, whereas in the ordered specimens superlattice dislocations were observed on the basal plane. (Metals Abst.)

17730 SOLUBILITY OF MOLYBDENUM IN GAMMA IRON. Alberry, P. J.; Haworth, C. W. Met. Sci. J.; 9: No. 3, 140(Mar 1975).

The $\alpha/\alpha+\gamma$ phase boundary in the Fe–Mo system was investigated. Diffusion couples were prepared between pure Fe and an Fe–5.05 at.-% Mo alloy and electron probe microanalysis was used to measure concentrations near the α/γ boundary. A maximum limit to the γ loop of 2.3 at.-% Mo was found. (Metals Abstr.)

17731 EFFECTS OF MOLYBDENUM AND TUNGSTEN ON THE LONG-PERIOD CREEP RUPTURE STRENGTH OF 12% CHROMIUM HEAT RESISTING STEEL CONTAINING VANADIUM, NIOBIUM, AND BORON. Fujita, T.; Yamada, T.; Takahashi, N. Tetsu To Hagane; 61: No. 3, 357-370(Mar 1975). (In Japanese)

A 12% Cr is one of the most economical heat resisting steels. It is, however, inferior to austenitic heat resisting steels in creep rupture strength >600°C. The effects of Mo and W were investigated to improve the creep rupture strength of 12% Cr heat resisting steel containing V, Nb, and B. The creep rupture strength of 12% Cr heat resisting steel is increased by the additions of Mo and W which result in solid-solution strengthening as well as precipitation hardening. In the case of a single addition, the optimum amount of Mo is ~3.0%. In a combined addition, optimum amounts of Mo and W are both ~1.0%. Coalescence of precipitated carbide particles is retarded by additions of Mo and W to the steel. (Metals Abstr.)

17732 NATURE OF THE QUASIPERIODIC (MODULATED) STRUCTURE IN Fe–Be ALLOYS. Tyapkin, Yu. D.; Evtushenko, T. V.; Travina, N. T.; Kovalenko, V. I. (Central Scientific Research Inst. of Ferrous Metallurgy, Moscow). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 5, 858-860(May 1975). (In Russian)

The decomposition of the supersaturated solid solution of Fe–Be alloys with 16.5 and 19.5 at.% Be during annealing at 350 to 500°C was investigated. The study was made by the dark-field electron microscopic method in the reflections of the precipitated phases and diffusion scattering of electrons and x rays. From the statistical processing of the electron microphotograph, quantitative parameters, characterizing the spatial distribution of the particles of the second phase with respect to each other, were obtained. It was established that the formation of a three-dimensional quasiperiodic structure appears in the coagulation stage. The presence of a sharp minimum of the elastic energy for a given crystalline direction, particularly the direction ⟨100⟩, is the decisive factor in this process. (tr-auth)

17733 INTERFACIAL LEDGE STRUCTURES IN Ni_3Al–Ni_3Nb EUTECTIC COMPOSITES. Garmong, G.; Rhodes, C. G. (Rockwell International, Thousand Oaks, CA). Metall. Trans., A; 6A: No. 12, 2209-2216(Dec 1975).

The interfacial structure of Ni_3Al–Ni_3Nb directionally solidified eutectic composites has been investigated by transmission electron microscopy. These interfaces contain at least three distinguishable arrays of features. Two of the arrays, misfit dislocations, have been discussed previously by Nakagawa and Weatherly. The third set, ledges which can fulfill both structural and kinetic growth functions, may interact with the dislocation arrays through strain-energy mechanisms. The interaction is manifested both as a local alteration of the line vector of the dislocation in certain circumstances, and as a change in the response of the dislocation image to ← anti g electron-microscope image-contrast experiments. A simple model of the strain field of a ledge based on that of an edge dislocation is formulated to rationalize the behavior of a misfit dislocation lying in close proximity to a ledge. The interaction of ledges and dislocation segments is expected to have significance in physical processes of practical interest such as production of matrix slip dislocations, misfit dislocation rearrangement, boundary sliding, and coarsening. These processes are discussed. (auth)

17734 EFFECTS OF SOLUTION AND INTERMEDIATE HEAT TREATMENTS ON THE NOTCH-RUPTURE BEHAVIOR OF INCONEL 718. Muller, J. F.; Donachie, M. J. Jr. (Los Alamos Scientific Lab., NM). Metal. Trans., A; 6A: No. 12, 2221-2227 (Dec 1975).

The effects of solution and intermediate heat treatments on the notch stress-rupture properties of Inconel 718 were investigated using commercial quality barstock. It was determined that a solution heat treatment of 1038°C for as short a time as 20 min could render this alloy notch-sensitive by solutioning extensive quantities of the orthorhombic Ni_3Nb delta phase. Restoration of notch ductility subsequent to a 1038°C (20 min) solution heat treatment was accomplished by the insertion of a 917°C (10 h) intermediate heat treatment, prior to aging, during which significant quantities of the delta phase were precipitated. This intermediate heat treatment was not successful in restoring notch ductility to specimens which had been given longer, 1 h, solution heat treatments at 1038°C. A 954°C (8 h) intermediate heat treatment was also not successful in restoring notch ductility to specimens solution heat treated for 20 min at 1038°C. It was confirmed that the most important factors controlling the notch-rupture ductility in Inconel 718 are the size, quantity, and distribution of the delta phase. The grain size of the material did not directly control the notch properties. (auth)

17735 SURFACE REACTION CONTROLLED OXYGEN ABSORPTION IN A Ta-8 W-2 Hf ALLOY: KINETICS AND CONCENTRATION GRADIENTS. Carpenter, R. W.; Liu, C. T. (Oak Ridge National Lab., TN). Metal. Trans., A; 6A: No. 12, 2235-2241(Dec 1975).

It is known that the rate of oxygen absorption in several bcc metals and alloys under conditions of low oxygen pressure and high temperature is controlled by the absorption rate of oxygen at the gas-metal interface, but the relationships between absorption rate, oxygen concentration gradient, and average oxygen concentration were not previously studied in detail. These relationships are examined using several different solutions of the diffusion equation to represent the absorption process, and the relations derived are compared with oxygen absorption measurements for a Ta–8 W–2 Hf alloy under the appropriate experimental conditions. It was found that the absorption rate and oxygen gradient were accurately described by a solution of the diffusion equation using a constant oxygen flux into the specimen as the external boundary condition. The rate limiting step in the process is the oxygen absorption rate at the gas-metal interface. This phenomenological model should also properly describe the oxygen absorption behavior of pure metals under the same conditions when the process is controlled by the absorption rate at the gas-metal interface, provided the sticking coefficient does not change during absorption. (auth)

17736 THERMODYNAMIC PROPERTIES OF ALPHA NICKEL–INDIUM ALLOYS. Bhattacharya, D.; Masson, D. B. (Pennsylvania State Univ., University Park). Metall. Trans., A; 6A: No. 12, 2273-2277(Dec 1975).

The vapor pressure of indium over alpha Ni–In alloys was measured by atomic absorption. The thermodynamic activity of indium was calculated from the vapor pressure, and the partial and integral entropy and enthalpy were calculated from temperature coefficients. It was found that the excess chemical potential of indium increases with atom fraction of indium at low temperatures, in the manner generally observed with similar alloys, but that the slope changes sign, causing DELTA anti G/sub In//sup xs/ to decrease with increasing x/sub In/ at high temperatures. An analysis of the components of the excess entropy indicated that the excess entropy, which has a large negative value, has a major contribution which can be attributed to the conduction electrons. Such an electronic contribution to DELTA S/sup xs/ is in accord with the band structure thought to characterize nickel-base alloys. (auth)

17737 FACTORS AFFECTING THE TENSILE DUCTILITY OF A METASTABLE BETA TITANIUM ALLOY. Chait, R. (Materials and Mechanics Research Center, Watertown, MA). Metall. Trans., A; 6A: No. 12, 2301-2303(Dec 1975).

The ductility of extruded heavy-section Ti-base–Mo–V–Fe–Al alloy was studied. Metallographic evidence for the large effect of grain size on ductility is presented. Fracture was found to occur in large-grain material after less deformation than in smaller grain size specimens. (JRD)

17738 OBSERVATIONS OF ANTI-PHASE BOUNDARIES IN THE gamma'-PHASE OF A DEFORMED NICKEL-BASE ALLOY. Axter, S. E.; Polonis, D. H. (Univ. of Washington, Seattle). Scr. Metall.; 9: No. 12, 1289-1292(Dec 1975).

Observations are presented concerning the antiphase boundaries in the gamma' particles of a deformed Ni–Ta–Fe–Al alloy containing a bimodal dispersion of gamma' and gamma'' (DO_{22}) particles. It is noted that these observations have implications with respect to the design of high strength dispersion type alloys based on bimodal particle distributions. Shearing of gamma' by single dislocations doubles the effect of gamma' on the yield strength over that of paired dislocations. The simultaneous occurrence of gamma'' by-passing and gamma' shearing should reduce the length of dislocation pile-ups thereby promoting toughness. (JRD)

17739 COMMENTS ON AMPLITUDE DEPENDENT DAMPING IN ZIRCONIUM. Ritchie, I. G.; Atrens, A. (Atomic Energy of Canada Ltd., Pinawa, Manitoba). Scr. Metall.; 9: No. 12, 1313-1316(Dec 1975).

Data and arguments are presented to show that the analytical results by Fernandez and Povolo [Phil. Mag., 31: 1081 (1975)] on

damping versus strain amplitude spikes in Zr containing small quantities of H at 77°K are incorrect. It is noted that for this analysis to yield reasonable values of Ln/Lc where Lc is the average loop length and Ln is the constant network lengths, the temperature, T, must be very small implying that very few dislocations take part in the breakaway process. This is the case if fresh dislocations associated with the hydride particles are responsible for the spikes. This invalidates the analysis by Fernandez and Povolo. (JRD)

17740 DISLOCATION MOTION IN SUPERCONDUCTORS. Galligan, J. M.; Tregilgas, J. H. (Univ. of Connecticut, Storrs). Scr. Metall.; 9: No. 12, 1321-1323(Dec 1975).

The strain rate sensitivity of the flow stress of pure Pb crystals was measured at 4.2°K. It was found that the effects of changing the strain rate on the flow stress is much more pronounced when the crystal is deformed in the normal state than when the crystal is deformed in the superconducting state. (JRD)

17741 COMMENTS ON "EXPERIMENTAL OBSERVATIONS OF CONTINUOUS TRANSFORMATIONS IN BINARY ALLOYS". Moreen, H. A.; Taggart, R.; Polonis, D. H. (Univ. of Washington, Seattle). Scr. Metall.; 9: No. 12, 1331-1332(Dec 1975).

Discussions of transformation modes in Ni–V alloys for continuous ordering transformations in terms of microstructure by Tanner and Laughlin [Scripta Met., 9: 373-78 (1975)] are examined. It is agreed that transformations in many alloys may be adequately described as either Mode I or Mode II, however, it appears that the specific modes may not always be distinguished on the basis of the microstructure alone—the nonstoichiometric Ni–V alloy is a case in point. (JRD)

17742 IRREVERSIBLE EFFECT OF HYDROSTATIC PRESSURIZATION ON YIELDING IN NIOBIUM. Aichbhaumik, D.; Haworth, W. L. (Wayne State Univ., Detroit). Scr. Metall.; 9: No. 12, 1351-1353(Dec 1975).

The irreversible effects of hydrostatic pressurization on the mechanical properties of polycrystalline Nb were studied. It was found that for prior pressures up to and including 3,45 MPa, there is no detectable change in the yield stress. Prior pressurization at 6,9 MPa eliminates the yield drop and sharp yield point at room temperature and reduces the yield stress at all temperatures. Pressurization at higher pressures causes a correspondingly greater decrease in yield stress. The fractional change in yield stress for a given prior pressure is greater at lower temperatures. The mechanical behavior of pre-pressurized niobium differs from that of other bcc metals such as iron and chromium mainly in that the critical pressure to induce an irreversible effect on mechanical properties is about two orders of magnitude lower than those previously observed. (auth)

17743 ADSORPTION OF LANTHANIDE ON THE SURFACE OF IRIDIUM AND THE EFFECT OF OXYGEN ON THE CONCENTRATION DEPENDENCE OF THE WORK FUNCTION OF THE FILM SYSTEM Ir–Yb. Ionov, N. I.; Medvedev, B. K. (Leningrad State Univ.). Sov. Phys. – Solid State (Engl. Transl.); 17: No. 3, 509-512(Mar 1975).

Translated from Fiz. Tverd. Tela: 17: No. 3, 800-805(Mar 1975).

The temperature-modulation method has been used to measure the kinetic characteristics of the thermal desorption of Yb atoms from the surface of a textured iridium strip oriented with the ⟨111⟩ face at the surface. Values of the heat of desorption of Yb atoms ($l_0 = 4.8 \pm 0.2$ eV) and of the preexponential constant in the kinetic equation of thermal desorption ($\log D = 13.7 \pm 0.4$) were obtained. The heat of desorption of singly charged ions $l_+ = 5.1$ eV was calculated from the Schottky relationship. A qualitative conclusion regarding the high values of the adsorption energy of the bond in the systems Ir–La, Ir–Ce, and Ir–Sm is drawn from the results of an experimental study of the adsorption of La, Ce, and Sm on Ir. It is shown that La films on Ir surfaces at about 1800°K have a diffuse character with degrees of coverage $\theta < 1$. The concentration dependence of the work function $\varphi(\theta)$ has been obtained for the systems Ir–La and Ir–Yb at various temperatures, and the effect of oxygen on the form of this dependence has been investigated in the case of the system Ir–Yb. (auth)

17744 WEAKENING OF FORCE CONSTANTS IN SnCd AND SnBi ALLOYS. Brandt, N. B.; Snigirev, V. G. (Moscow State Univ.). Sov. Phys. – Solid State (Engl. Transl.); 17: No. 3, 578-579(Mar 1975).

Translated from Fiz. Tverd. Tela: 17: No. 3, 910-913(Mar 1975).

Weakening of force constants in SnCd and SnBi alloys was examined at 273 and 77°K. The Moessbauer effect was observed in the ^{119}Sn host atoms. Cd impurity atoms are bound to tin less strongly than Bi impurities. A greater weakening of the force constants found in the case of Cd causes the lighter Cd atoms to vibrate with essen[illegible] the same frequency as the Bi atoms. It is noted that the lower the volume occupied by an impurity atom, the weaker the binding of this atom to the host lattice. (JRD)

17745 MECHANISM AND KINETICS OF ORDERING IN INTERMETALLIC COMPOUND Co_3W. Larikov, L. N.; Barabash, O. M.; Omel'yanenko, V. V.; Takzei, G. A.; Shmatko, O. A. (Inst. of Metal Physics, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 9, 825-827(Sep 1975). (In Ukrainian).

The mechanism and kinetics of ordering in intermetallic compound Co_3W are studied by the methods of high-temperature roentgenography, dilatometry, and differential thermal analysis. It is established that the disordering process occurs by the type of the first kind phase transformation within a temperature range of 1020 to 1100°C and is connected with nucleation of the disordered phase on the boundaries of the initial ordered phase. (auth)

17746 THERMODYNAMIC PROPERTIES AND SUPERCONDUCTING TRANSITION TEMPERATURE OF DILUTE SOLUTIONS OF Hf, Ta, AND W IN V. Shikov, A. A.; Chernoplekov, N. A.; Panova, G. Kh.; Samoilov, B. N.; Zhernov, A. P. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1825-1833(Nov 1975). (In Russian).

The specific heats of VHf alloys (0.9 at.%) and VW (5.2 at.%) alloys are measured between 1.2 and 40°K in the absence of a field and at 1.2 to 6°K in an 18 kOe field. Similar investigations were previously carried with pure V and its alloy containing Ta. Introduction of heavy impurity atoms of Hf, Ta, or W into the V lattice results in an anomalous temperature behavior of the impurity part of the phonon specific heat. This indicates that quasilocal oscillations arise. Despite the almost equal masses of the impurity atoms, the magnitudes and positions of maxima of the quantity $\Delta C_\Phi/C_{\Phi\eta}$ is found to differ considerably for VHf, VTa, and VW alloys due to variation of the effective force constants. (auth)

17747 STRUCTURAL STATE OF A SUPERCONDUCTING MODIFICATION OF BERYLLIUM STABILIZED WITH AN ALUMINUM IMPURITY. Lazarev, B. G.; Semenenko, E. E.; Tutov, V. I.; Kornienko, L. A.; Deineko, S. A. (Physical-Technical Inst., Kharkov). Dokl. Akad. Nauk SSSR; 223: No. 4, 838-840 (1 Aug 1975). (In Russian).

Results are presented of electronographic studies of BeAl layers ~ 1000 Å thick containing 70% Be and 30% Al with simultaneous measurement of the superconducting properties. Results showed that the layers were a mixture of beryllium and aluminum crystallites. The average crystallite size is ~90 Å for beryllium, and does not change at room temperature with annealing time. The average crystallite size is 60 Å for beryllium, and increases to 80 Å during the annealing period. By the technique used in this study it was not possible to investigate the layers directly at the temperature of layer formation. By use of the technique which was used it is not possible to isolate small (<10%) concentrations of a new phase. The superconducting transition temperature is raised to ~9°K in the condensed beryllium and aluminum layers. (SJR)

17748 MAGNETIC PROPERTIES OF TERBIUM IN THE PARA-PROCESS REGION. Ponomaryov, B. K.; Moryeva, N. I. (Inst. of Solid State Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 4, 1352-1361(Oct 1975). (In Russian).

Magnetization of a terbium single crystal in the easy magnetization direction (basal plane of the crystal) is measured in a pulsed magnetic field of intensity up to 380 kOe and duration 0.01 sec between 80 and 380°K. It is shown that in a broad field strength and temperature range the iso-magnetization lines of terbium differ qualitatively from those of $Fe_{85}(Ni_{1-x}Mn_x)_{15}$ alloys. This is explained by the difference in types of statistical distributions which are used to describe the magnetic moment carriers in the respective substances. It is suggested that the difference in behavior of the iso-magnetization lines exists not only for terbium and iron-nickel-manganese alloys but also between groups of 4f- and 3d-ferromagnetic metals. It is shown that the molecular field as a function of magnetization can be found from the iso-magnetization lines of terbium. For magnetization values of the order of 300 Gs · cm³/g the molecular field of terbium may reach 900 kOe. (auth)

17749 HIGH-FIELD MAGNETIZATION OF THE Tb SINGLE CRYSTALS. Roeland, L. W. (Amsterdam Univ.); Cock, G. J.; Lindgard, P. A. J. Phys., C (London); 8: No. 20. 3427-3438 (21 Oct 1975).

The magnetization of Tb single crystals was measured in magnetic fields up to 34 T along the hard direction at temperatures of 1.8, 4.2, 65.5, and 77°K, and along the easy direction at 4.2 and 77°K. The data are compared with the results of a self-consistent spin wave calculation using a phenomenological Hamiltonian including isotropic exchange interactions, effective single-ion

anisotropy, and magneto-elastic contributions. The parameters of this Hamiltonian were determined by fitting the theoretical results for the spin wave dispersion and energy gap as a function of temperature and magnetic field to existing data on Tb. The magnetization as a function of temperature and field agrees well with the experimental values. From the temperature dependence it may be concluded that a substantial part of the anisotropy is probably not of crystal-field origin. The conduction-electron polarization at zero field and temperature is $(0.33 \pm 0.05)\mu_B$/ion, and the susceptibility is greater than the Pauli susceptibility calculated from the band-structure. (auth)

17750 DETERMINATION OF THE ELECTROSTATIC CONTRIBUTIONS TO LANTHANIDE QUADRUPOLAR CRYSTAL FIELDS. Newman, D. J.; Price, D. C. (Australian National Univ., Canberra). J. Phys., C (London); 8: No. 18, 2985-2991 (21 Sep 1975).

Recently-determined values of the nuclear quadrupole splitting in ^{155}Gd are employed as input data to a new model which separates the electrostatic contributions to lanthanide crystal fields from the 'contact' contributions due to overlap, covalency and charge penetration. This separation allows a new and more precise value of the quadrupolar shielding parameter σ_2 to be obtained. (auth)

17751 CRYSTAL FIELD AND MOESSBAUER SPECTROSCOPY OF THE INTERMETALLIC COMPOUND $DyCo_3$. Yakinthos, J. K. (Democritus Nuclear Research Center, Athens); Chappert, J. Solid State Commun.; 17: No. 8, 979-981(15 Oct 1975).

A comparison is made of the electric field gradient at the Dy nucleus in $DyCo_3$ estimated by a point charge calculation and that measured by Mössbauer spectroscopy. (auth)

17752 VAPOR-DEPOSITED LEAD FILMS AND THEIR TRANSPORT CHARACTERISTICS AT LOW TEMPERATURES. II. Thermal Conductivity. Pompe, G.; Schmidt, K. (Technische Univ., Dresden). Phys. Status Solidi (a); 31: No. 1, 37-46(Sep 1975).

Measurements are made of thermal conductivity of lead films in the temperature range from 5 to 20°K. The film thickness varies between 1100 and 16000 Å. The conditions for deposition are characterized by a pressure of about 5×10^{-6} torr and a substrate temperature of about 300°K. The experimental values obtained for thermal resistivity deviate from Matthiessen's rule. An additional thermal resistivity $\Delta W(d, T) \sim d^{-4/5}$ exists analogously to the electrical resistivity. A dependence between the electron–phonon-scattering coefficient and the electron–imperfections scattering coefficient can be observed. In connection with the experimental values for the electrical conductivity, the Lorenz number is calculated. For T > 10°K the Lorenz number of thin films has an anomalous temperature dependence. The experimental results obtained in the superconducting range show that the electron–phonon interaction on the thermal resistivity of the film is still of considerable importance. (auth)

17753 ISOTHERMAL CURRENT-VOLTAGE CHARACTERISTICS OF LONG SUPERCONDUCTING FILMS. Eru, I. I.; Peskovatskii, S. A.; Poladich, A. V. (Inst. of Radiophysics and Electronics, Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 6, 903-911(Jun 1975). (In Russian).

The current-voltage characteristics of long (30 to 500 μm) superconducting lead and tin films were studied within wide intervals of thicknesses, widths, and temperatures (40 to +2000 Å, 6 to 2000 μm and 1.8 to 4.2°K, respectively). Film heating in the resistive state did not exceed (0.2 to 0.5) ($T_c - T$). An analysis of the obtained characteristics was carried out in terms of the «current» transition model taking into account the relaxation processes in a superconductor. Such an analysis is shown to be of use in explaining the main peculiarities of these characteristics and in obtaining information on physical parameters of the superconductor, including the relaxation ones. (auth)

17754 SUPERCONDUCTING PROPERTIES OF VANADIUM–NIOBIUM–MOLYBDENUM ALLOYS. Sirota, N. N.; Stribuk, E. K. (Inst. of Solid State Physics and Semiconductors, Minsk). Dokl. Akad. Nauk SSSR; 222: No. 6, 1329-1331(21 Jun 1975). (In Russian).

The V–Nb–Mo system forms continuous solid solutions which are superconductors. The superconducting transition temperature T_c of the ternary alloys under study was determined by a resistive method. On increasing the molybdenum content to 40 at.%, the transition temperature falls sharply. For all the alloys in the annealed state, the values of the critical magnetic field do not exceed ~20 kOe. This study shows that molybdenum has the greatest effect on decreasing the superconducting transition temperature. (SJR)

17755 ENHANCEMENT OF THE CURRENT-CARRYING CAPACITY OF Nb_3Sn FOILS IN MAGNETIC FIELDS ABOVE 100 kOe. Alekseevskii, N. E.; Bazan, C.; Berthel, K. H.; Ermolov, V. A.; Hesske, R. R.; Zaitsev, G. S. (International Lab. of High Magnetic Fields and Low Temperature, Wroclaw). Phys. Status Solidi (a); 31: No. 1, 283-288(Sep 1975).

The critical currents of Nb_3Sn foils prepared by two different methods have been measured in a temperature range from 4.2 to 16°K and in fields up to 170 kOe. The foils made by a two-stage diffusion process have critical current densities between 2.6 and 3.5×10^4 A/cm^2 averaged over the whole cross section of the samples in fields of 150 kOe. That means that they have critical current densities of 8 to 10 times higher than foils made by Kunzler's method. These current densities are comparable to those of the best internationally known undoped Nb_3Sn tapes. Electronmicroscopic images show the ability of producing foils having uniform layer thickness by the two-stage diffusion process. (auth)

17756 ORIENTATION DEPENDENCE OF THE LOW TEMPERATURE RELAXATION PEAK IN Nb + O + H. Schiller, P.; Nijman, H. (EURATOM, Ispra, Italy). Phys. Status Solidi (a); 31: No. 1, K77-K79(Sep 1975).

Results of internal friction measurements on H- and O-containing Nb single crystals are presented. These measurements were made to determine the dependence of the low temperature hydrogen relaxation peak on the crystal orientation. It was found that the symmetry axis of the mobile part of the elastic dipole connected with the oxygen/hydrogen pair in Nb has its stable positions parallel to one of the (111) directions. The position of the bonded hydrogen interstitial is different from the one assumed for the free hydrogen. (JRD)

17757 TEMPERATURE DEPENDENCE OF THE DISHARDENING EFFECT IN PURE LEAD INVOLVED IN THE SUPERCONDUCTING TRANSITION. Abraimov, V. V.; Soldatov, V. P.; Startsev, V. I. (Physical-Technical Inst., Kharkov). Zh. Eksp. Teor. Fiz.; 68: No. 6, 2185-2194(Jun 1975). (In Russian)

The temperature dependence of the creep discontinuity $\delta\epsilon_{ss}$ and the ratio of the plastic deformation rates in the S and N states, ϵ_s/ϵ_n, in the superconducting transition of lead single crystals (99.999%) are investigated in the 1.6–7.2 K temperature range and in a broad deformation range. It is found experimentally that the nature of the temperature dependence of $\delta\epsilon_{ss}$ and the creep rates in the S and N states depend on the degree of deformation, i.e., depend on the imperfect structure of the crystal. Comparison with existing theories of dishardening yields satisfactory agreement with the fluctuation theory under the assumption of a one-band isotropic superconductor. (6 figures) (auth)

17758 APPEARANCE OF STRUCTURE FORMATIONS IN THE GRAIN REFINING IN Mg–Zr ALLOYS. Lindau, J. (Martin-Luther Univ., Halle-Wittenberg, Ger.); Sauerwald, F. Z. Phys. Chem. (Leipzig); 256: No. 2, 209-216(1975). (In German)

Narrow rods of Mg–Zr alloy were melted through the middle by a high current. The low amount of melt formed in the melted site solidified rapidly in fine crystalline form. In many of these crystallites a particle is found in a central position which can be considered without difficulty as a nucleus. This result represents a confirmation for the significance of the grain refining effect in Mg–Zr alloys by the nucleus effect of Zr particles. A short annealing of these alloys under the special conditions of rapidly solidified molten zones leads to a coarsening of the grain and grain boundary changes as well as to textures such as those occurring under the usual slow annealing conditions in solidified Mg–Zr alloys. (tr-auth)

17759 PROPERTIES OF SUPERCONDUCTING ALLOYS WITH A15 LATTICE TYPE, OBTAINED BY EVAPORATION IN VACUUO. Golovashkin, A. I.; Levchenko, I. S.; Motulevich, G. P. Tr. Fiz. Inst., Akad. Nauk SSSR; 82: 72-102(1975). (In Russian)

The alloys Nb–Sn, Nb–Sn–Gd, Nb–Sn–Cu, Nb–Al, Nb–Ga, Nb–Al–Ge, V–Ga, V–Ga–Ge, and V–In–Ge with lattice type A15 were studied. All alloys were obtained by simultaneous evaporation of the components from different evaporators in a vacuum. For each alloy the optimum conditions of preparation and subsequent processing are presented. The superconducting properties determined were transition temperature in the superconducting state, width of the transition, critical current and its dependence on temperature, and a number of static properties such as density, lattice constants, and static conductivity and its dependence on temperature. 42 references. (tr-auth)

17760 SUPERCONDUCTING PROPERTIES OF A COPPER-TERNARY ALLOY. Sharma, R. G.; Aleksivskii, N. E. (Inst. of Physical Problems, Moscow). J. Phys., D (London); 8: No. 15, 1783-1786(21 Oct 1975).

The superconducting properties of a copper-ternary alloy of the type $Cu_{93}Nb_3Sn_2$, subjected to a variety of mechanical and heat treatments, are discussed. The as-cast alloy does not turn superconducting down to 4.5°K; but the cold-work and subsequent prescribed heat treatments are found to raise the transition temperature T_c to values as high as 18.1°K and the critical current density J_c (of the Nb_3Sn formed during annealing) to a value of 3.6×10^5 A cm^{-2} (at 4.2°K and 30 kOe). Various possibilities to improve J_c of this alloy to still higher values are discussed. The as-cast alloy is ductile, easy to draw, and economical from a technical point of view, and the annealed wires and strips are flexible enough for winding. (auth)

17761 INVESTIGATION OF THE ELECTRONIC STRUCTURE OF A GLASSY $Pd_{0.775}Cu_{0.06}Si_{0.165}$ ALLOY BY ANGULAR CORRELATION STUDIES OF POSITRON-ANNIHILATION RADIATION. Chuang, S. Y.; Tao, S. J.; Chen, H. S. (New England Inst., Inc., Ridgefield, CT). J. Phys., F (London); 5: No. 9, 1681-1685(Sep 1975).

The angular correlation of positron-annihilation radiation from a glassy, a partially crystalline and a crystalline $Pd_{0.775}Cu_{0.06}Si_{0.165}$ alloy as well as a pure palladium sample was measured. The angular correlation curve for the glassy alloy varies slightly upon crystallization, indicating that the glassy alloy contains negligible vacancy-like defects. The localization of the positron in the glassy state may account for this small change in the angular distribution. The low momentum region of the alloy curves shows an appreciable deviation from that of the free electron model. The observed Fermi momentum of the alloy is larger than that of Pd which agrees qualitatively with the calculated Fermi momentum based on the assumption that the d band of Pd in the alloy is completely filled by valence electrons from Si. The low momentum region of the alloy curve is much higher than that of Pd. The explanation of this is discussed in terms of the increase of the valence electron concentration, the strong association locally between Pd and Si, and the relative positron affinity in the alloy. (auth)

17762 MAGNETOSTRICTION OF SOME CUBIC RARE EARTH-CO_2 COMPOUNDS IN HIGH MAGNETIC FIELDS. del Moral, A.; Melville, D. (Southampton Univ., Eng.). J. Phys., F (London); 5: No. 9, 1767-1777(Sep 1975).

Magnetostriction measurements have been carried out in the cubic Laves phase compounds $DyCo_2$, $HoCo_2$ and $ErCo_2$ from 10°K to well above their respective Néel temperatures T_N. Pulsed magnetic fields up to 15 T (150kOe) were applied. The observed magnetostrictions are very large ($\sim 10^{-3}$) being similar to those found in the RFe_2 compounds. The measurements confirm the extremely high anisotropy of these materials. At the highest fields the polycrystalline samples are still undergoing rotational magnetization processes. The expected values of the saturation magnetostriction at 0°K are similar in sign and magnitude to those found in the corresponding rare earth metals. This fact and the scaling of magnetostriction with rare earth sublattice magnetization indicate that the rare earth ion is the main source of the magnetostriction. The metamagnetic transition above T_N has been studied, the relation between critical field and temperature being nonlinear for $HoCo_2$ and $ErCo_2$. The compounds are highly anisotropic above T_N and all the features indicate that the field-induced phases are likely to be ferromagnetic. (auth)

17763 CRYSTALLOGRAPHIC AND MOESSBAUER INVESTIGATIONS OF $Dy(Fe_{1-x}Co_x)_3$ AND $Y(Fe_{1-x}Co_x)_3$ AND $Y(Fe_{1-x}Co_x)_3$ INTERMETALLIC COMPOUNDS. Arif, S. K.; Bunbury, D. S. P.; Bowden, G. J. (Manchester Univ., Eng.). J. Phys., F (London); 5: No. 9, 1792-1800(Sep 1975).

Crystallographic and Moessbauer studies were carried out on the $Dy(Fe_{1-x}Co_x)_3$ and $Y(Fe_{1-x}Co_x)_3$ intermetallic compounds. The replacement of Fe by Co leads to positive deviations of the a and c lattice parameters from Vegard's law as well as maxima in the ^{57}Fe hyperfine field and the ordering temperature when $x = 0.3$ to 0.5. The direction of magnetization of the $Y(Fe_{1-x}Co_x)_3$ system is found to change from the b axis ($\Theta = 90°$, $\phi = 30°$) at $x = 0$ to the b-c plane ($\Theta = 78°$, $\phi = 30°$) at $x = 0.6$. Similarities between the pure Fe–Co binary alloys and pseudobinary $R(Fe_{1-x}Co_x)_2$ and $R_2(Fe_{1-x}Co_x)_{17}$ compounds are also noted. (auth)

17764 TEMPERATURE DEPENDENT HYPERFINE INTERACTIONS IN THE INTERMETALLIC COMPOUNDS YFe_3, $TbFe_3$, AND $ErFe_3$. Arif, S. K.; Bunbury, D. S. P.; Bowden, G. J. (Manchester Univ., Eng.). J. Phys., F (London); 5: No. 9, 1785-1791(Sep 1975).

The temperature dependent hyperfine interactions of ^{57}Fe nuclei in the intermetallic compounds RFe_3, where R = Y, Tb and Er have been studied using the Mössbauer effect. It was found that YFe_3 and $TbFe_3$ remain magnetized along a b axis at all temperatures whereas $ErFe_3$ is magnetized along a c axis despite a marked change in the character of the Mössbauer spectrum between 4.2 and 77°K. It is also argued that there is no substantial difference in the electronic configurations of the iron atoms at their two main inequivalent crystallographic sites, as witnessed by the temperature dependence of the total shift and the hyperfine fields. The quadrupole parameters were found to be temperature independent and to originate primarily from the lattice. The analogy between similar properties of the RFe_2 and the RFe_3 is also presented. (auth)

17765 OPTICAL AND ELECTRON PROPERTIES OF SOME TRANSITION METALS. Mash, I. D. Tr. Fiz. Inst., Akad. Nauk SSSR; 82: 3-71(1975). (In Russian)

Samples of Ti, V, and three alloys of Nb–V alloys were prepared for use in determining the optical constants for nondeformed lattices in these metals and alloys in the spectral region 0.4 to 10 μm. The electron characteristics were calculated: electron concentration in the conductor, effective frequency of collision of electrons, average rate of electrons at the Fermi surface, and Fermi surface area. Parameters of the band of inter-zone conductivity were determined, and inter-zone transitions were related to the lines of crossing of some Bragg densities for metals with A1, A2 lattices with valence of 10 and for metals with A3, A15 lattices with valence of 5. Inter-zone bands of conductivity were identified and Fourier components of pseudopotential were determined for Ti, V, and Nb–V alloys. The frequencies of the inter-zone conductivity band of superconducting alloy Nb_3Sn were determined, and the qualitative picture of inter-zone transition in this alloy was obtained. The optical properties of Ti, V, and Nb–V alloys agreed with those proposed for full hybridization of all valence electrons and use of pseudopotential approximations. 94 references. (auth-tr)

17766 SPIN ROTATION IN TERNARY $Ho_{0.6}Tb_{0.4}Fe_2$. Dublon, G. (Nuclear Research Centre-Negev, Post Office Box 9001, Beer-Sheva, Israel); Atzmony, U.; Dariel, M.P.; Shaked, H. Phys. Rev. B 12: No. 11, 4628-4633 (1 Dec 1975).

The spin rotation which takes place in the ternary cubic Laves phase compound $Ho_{0.6}Tb_{0.4}Fe_2$ was studied by means of neutron diffraction and Mössbauer-effect spectroscopy. The neutron diffraction measurements were carried out on an aligned powder sample as a function of temperature (4.2–300 K) and external magnetic field (0–8 kOe). Mössbauer spectra of ^{57}Fe were obtained over a 77–200-K temperature range. The spin rotation in $Ho_{0.6}Tb_{0.4}Fe_2$ is found to take place over the temperature interval 90–140 K. The experimental results enable the determination of the direction of the ferrimagnetic axis as a function of temperature within the spin-rotation interval. (auth)

17767 CRYSTAL-FIELD EFFECTS ON THE SUPERCONDUCTING TRANSITION TEMPERATURE OF $LaSn_3$:Pr, $LaPb_3$:Pr, AND $LaTl_3$:Pr. Lethuillier, P. (Laboratoire de Magnétisme, Centre National de la Recherche Scientifique, B.P. 166, 38042-Grenoble-Cedex, France). Phys. Rev. B 12: No. 11, 4836-4838 (1 Dec 1975).

The crystal-field effects on the superconducting transition temperature of matrix LaX_3 (X=Sn, Pb, Tl) containing praseodymium impurities are examined. Using the theory of Fulde, we have taken into account all the crystal-field levels of the impurity. Exchange integrals Γ are evaluated from the depression of the superconducting transition temperature T_c in $La_{1-x}Pr_xX_3$ solutions. The large value of Γ found in $La_{1-x}Pr_xSn_3$ is in agreement with the observation of a Kondo effect in these compounds. (auth)

17768 HEAT CAPACITY OF TECHNETIUM. Trainor, R.J.; Brodsky, M.B. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. B 12: No. 11, 4867-4869 (1 Dec 1975).

The heat capacity of technetium has been measured in zero field between 3 and 15 K. A superconducting transition temperature $T_c = 7.86$ K is found. The electronic heat-capacity coefficient and zero-degree Debye temperature are 4.30 mJ/mole K^2 and 454 K, respectively. An electron-phonon enhancement factor of 0.65 is found from the McMillan equation. The thermodynamic properties of the superconducting state also indicate that technetium is an intermediate-coupling superconductor. (auth)

17769 LOW-TEMPERATURE HEAT CAPACITY OF α-URANIUM AND ITS RELATION TO THE PRESSURE DEPENDENCE OF T_c. Bader, S.D.; Phillips, N.E. (Inorganic Materials Research Division of the Lawrence Berkeley Laboratory, and Department of Chemistry, University of California, Berkeley, California 94720); Fisher, E.S. Phys. Rev. B 12: No. 11, 4929-4940 (1 Dec 1975).

The heat capacities of five samples of α-uranium, including one single crystal, have been measured between approximately 0.1 and 2 K, at zero pressure. The four polycrystalline samples showed broad bulk superconducting transitions. The single crystal, for which susceptibility measurements showed a transition near 0.3 K, was not completely superconducting at the lowest temperature of our measurements, and we estimate $T_c < 0.1$ K. The shapes of the heat-capacity anomalies associated with the transitions to the superconducting state were those

of broadened BCS transitions, thus showing that local moments and pair-breaking mechanisms are not involved in limiting the values of T_c. The value of γ, the coefficient of the electronic heat capacity, were significantly higher for the polycrystalline samples than for the single crystal, and there is evidence from other work of a similar trend in the lattice heat capacity. It is suggested that these trends are related to the pressure dependence of the same parameters, and that these pressure dependences and that of T_c are all produced by an unusual and strong pressure dependence of the phonon spectrum. (auth)

17770 SUPERCONDUCTING TRANSITION TEMPERATURE IN ϵ-PHASE Ag-Zn ALLOYS. Matsuo, S. (Department of Applied Physics, Nagoya University, Nagoya, 464, Japan); Mizutani, U.; Massalski, T.B.; Noguchi, S. Phys. Rev. B 12: No. 11, 4941-4944 (1 Dec 1975).

Superconducting transition temperatures were measured in four ϵ-phase alloys in the Ag-Zn system, in order to obtain a relation between the electron-phonon interaction and the electron concentration (electrons per atom, $\mathcal{Z}$). The results show that the strength of the interaction increases with $\mathcal{Z}$ throughout the ϵ-phase range but the increase becomes negligible for values of $\mathcal{Z}$ exceeding about 1.85. This change of behavior appears to coincide with the onset of electron overlaps across the {00.2} faces of the Brillouin zone, as indicated by other properties. (auth)

17771 SUPERCONDUCTIVE TUNNELING IN VANADIUM WITH GASEOUS IMPURITIES. Noer, R.J. (Department of Physics and Astronomy, Carleton College, Northfield, Minnesota 55057). Phys. Rev. B 12: No. 11, 4882-4885 (1 Dec 1975).

Electron-tunneling measurements have been made in vanadium films containing varying amounts of gaseous impurities. Transition temperatures T_c vary from near the bulk value to more than 2 K below it. After corrections are made for spurious leakage conductivity, tunneling characteristics are in all cases consistent with a simple BCS superconducting density of states. T_c and the zero-temperature energy gap $\epsilon(0)$ vary in accordance with $2\epsilon(0)/kT_c = 3.5 \pm 0.1$. In consequence, it does not appear that gaseous impurities enter the vanadium lattice in a paramagnetic configuration. (auth)

17772 FIELD DEPENDENCE OF THE SUPERCONDUCTIVE PENETRATION DEPTH IN TIN UP TO THE SUPERHEATING LIMIT. Parr, H. (Institute of Physics, University of Oslo, Oslo 3, Norway). Phys. Rev. B 12: No. 11, 4886-4898 (1 Dec 1975).

The superconductive penetration depth $\delta(T, H)$ has been studied as a function of temperature and field in single tin spheres, 15–30 μm in diameter. A mutual-inductance method was used with the 75-kHz measuring field parallel to the static field. When properly normalized, the variation of the transition signal with T and H is then proportional to $d[\delta(T, H) \times H]/dH$, where δ is the penetration depth averaged over the sphere surface. The results are independent of sphere diameter, and thus characteristic of bulk tin. In zero field, we find $\delta(T) = \delta_0/[1 - (T/T_c)^4]^{1/2}$, with $\delta_0 = 520 \pm 30$ Å. The field dependence was studied for temperatures close to T_c and fields up to the ideal bulk superheating field $H_{sh} \simeq 2.76H_c$, corresponding to a Ginzburg-Landau parameter $\kappa = 0.093 \pm 0.001$. The penetration depth increases sharply as the field approaches H_{sh}, but stays finite, while its derivative diverges. We find $\delta(H_{sh})/\delta(H = 0) = 1.51 \pm 0.04$. Averaged over the sphere, we have $\delta(H_{sh})/\delta(H = 0) = 1.19 \pm 0.01$. The field dependence is rather well described by one-dimensional Ginzburg-Landau theory in the low-κ limit. The results indicate that the surface order parameter ψ, is depressed by (30–50) % at H_{sh}. In "weak" fields, $H \leq 1.5H_c$, the data are consistent with the customary quadratic field dependence. (auth)

17773 MEASUREMENTS OF THE ELECTRON-PHONON INTERACTION IN Nb BY INELASTIC NEUTRON SCATTERING. Shapiro, S.M.; Shirane, G.; Axe, J.D. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. B 12: No. 11, 4899-4908 (1 Dec 1975).

Precise linewidth and frequency measurements of transverse acoustic modes propagating along the [001] and [110] directions were performed on single crystals of niobium in the normal and superconducting phases ($T_c = 9.2$°K). For transverse phonons propagating along the [110] direction changes in linewidth are observed when the superconducting gap $2\Delta(T)$ equals the phonon frequency. This behavior agrees with Bobetic's calculation for the attenuation of high-frequency sound waves in superconductors and the magnitude of the change enables us to calculate the electron-phonon interactions. In addition to linewidth changes, anomalous temperature dependence of the peak position of some acoustic modes is also observed. The [001] transverse phonons exhibit a *decrease* of ~15% when T is decreased from 300°K to T_c. Below T_c there is an additional softening of 3%. This softening extends along the [ζ00] direction to $\zeta = 0.5$, the limit of our measurements. (auth)

17774 NONEQUILIBRIUM QUASIPARTICLE CURRENT AT SUPERCONDUCTING BOUNDARIES. Yu, M.L. (Brookhaven National Laboratory, Upton, New York 11973); Mercereau, J.E. Phys. Rev. B 12: No. 11, 4909-4916 (1 Dec 1975).

Potential measurements have been made in the nonequilibrium depairing regions of current-carrying superconducting boundaries. Experiments performed on two different systems are reviewed. The first is the boundary between a superconductor and a normal metal. The second is the boundary between two superconductors with one of them driven normal by a current. In both cases, the quasiparticle chemical potential was found to be different from the potential of the pairs with current dependence depending on individual boundary conditions. The spatial extent of the nonequilibrium region was also found to be longer than the coherence length of the superconductor. A new interpretation for the experimental results is proposed. The theory is based on a nonequilibrium population of quasiparticles created during branch crossing in the depairing region. The branch-crossing relaxation time $\tau_Q(0)$ for our tantalum films was estimated to be $\sim 0.65 \times 10^{-10}$ sec. (auth)

17775 HYPERFINE FIELDS AT TRANSITION-ELEMENT IMPURITIES IN Gd. Brewer, W.D.; Wehmeier, E. (Fachbereich Physik der Freien Universität Berlin, Berlin, West Germany). Phys. Rev. B 12: No. 11, 4608-4616 (1 Dec 1975).

Low-temperature nuclear-orientation measurements on a number of dilute alloys of 3*d* and 4*d* transition elements in Gd host are reported. The derived hyperfine fields in kG are: *Gd*V, -87.4 ± 9.2; *Gd*Cr, $+23.1 \pm 5.4$.; *Gd*Mn, $+186.4 \pm 4.3$; *Gd*Y, -150 ± 7; *Gd*Zr, -100 ± 15; *Gd*Nb, -92.9 ± 0.8; *Gd*Mo, $+49 \pm 6$ or -40 (see text); and *Gd*Tc, $+87.6 \pm 2.9$. In addition, a Mössbauer-effect source experiment gives for *Gd*Fe a hyperfine field of 0 ± 16 kG. These results nearly complete the systematics for 3*d* and 4*d* impurities in Gd host, and support the model for Gd proposed by Campbell. We discuss the derived values of local moments for 3*d* and 4*d* impurities in Gd. (auth)

17776 MAGNETIC RESONANCE IN AMORPHOUS $TbFe_2$ AND $GdFe_2$. Bhagat, S.M.; Paul, D.K. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). Phys. Rev. Lett. 35: No. 21, 1458-1461 (24 Nov 1975).

We report measurements on the spin resonances in *a*-$TbFe_2$ and *a*-$GdFe_2$. A preliminary interpretation in terms of an oversimplified model involving clusters in a disordered material is also outlined. (auth)

17777 ELECTRONICALLY DRIVEN LATTICE INSTABILITIES. Sinha, S.K. (Solid State Science Division, Argonne National Laboratory, Argonne, Illinois 60439); Harmon, B.N. Phys. Rev. Lett. 35: No. 22, 1515-1518 (1 Dec 1975).

A general and physically simple model based on rigorous formulations of the dielectric function is presented and used to explain the phonon anomalies in niobium and niobium carbide. The model contains the explicit q dependence of both the electron-phonon and electron-electron interactions for localized states near the Fermi energy and appears quite useful for explaining the q dependence of phonon anomalies and lattice instabilities in various systems. (auth)

17778 NUCLEAR COOPERATIVE ORDERING IN SINGLE-CRYSTAL PRASEODYMIUM AT LOW TEMPERATURES. Lindelof, P.E.; Miller, I.E.; Pickett, G.R. (Department of Physics, University of Lancaster, Lancaster LA1 4YB, United Kingdom). Phys. Rev. Lett. 35: No. 19, 1297-1299 (10 Nov 1975).

We have observed a λ anomaly in the nuclear heat capacity of a single crystal of praseodymium known not to order down to 1.8 K. The anomaly is associated with a cooperative magnetic ordering of the hexagonal-site nuclei at 25–30 mK of the type discussed by Murao. This result is in contrast to earlier calorimetric measurements where ionic order has precluded cooperative nuclear processes. The cooperative anomaly is suppressed by a field of 1.5 T. (auth)

17779 ISOTROPIC KNIGHT SHIFT OF CADMIUM. Gupta, A. (Saha Institute of Nuclear Physics, Calcutta-700009, India); Kumar, S.; Ramchandani, M.G. Phys. Rev. B 12: No. 12, 5407-5409 (15 Dec 1975).

The isotropic knight shift of cadmium has been calculated using the band structure of cadmium calculated by Ramchandani. The calculated value of 0.305% agrees well with experimental values from 0.300% to 0.350%. The agreement between the experimental and calculated values of the isotropic Knight shift is considered to be good owing to the choice of a realistic potential which is based on Liberman's self-consistent calculation of atomic charge densities. (auth)

17780 LOW-TEMPERATURE ELECTRICAL RESISTIVITY OF NOBLE METALS. Borchi, E.; De Gennaro, S.; Tasselli, P.L. (Istituto di Fisica dell'Università, Firenze 50125, Italy). Phys. Rev. B 12: No. 12, 5478-5487 (15 Dec 1975).

We have accomplished a study of the low-temperature electrical resistivity for the noble metals silver and copper. We have described the Fermi surface of the noble metals by the simple eight-cone model and have taken into account two-orthogonalized-plane-wave corrections which are very important at the lowest temperatures. The use of the standard trial function in the variational formula for the resistivity makes the calculation more applicable to the temperature-dependent resistivity of impure samples. This interpretation is supported by comparison with the

available experimental data. Our results evidence the preponderance of the "umklapp" contribution to the low-temperature resistivity over the normal one. Moreover, they show that the resistivity as a function of temperature does not follow a well-defined power law, but, if one assumes the validity of a simple relation $\rho \sim T^n$, the exponent n varies continuously ranging from a value of nearly 6 to a value of nearly 4 in the region $T = 1$–15 K. (auth)

17781 ELECTRONIC DENSITY OF STATES OF LANTHANUM-TRANSITION-METAL ALLOYS OF $CaCu_5$ TYPE. Bennett, L.H.; McAlister, A.J.; Cuthill, J.R.; Erickson, N.E. (Institute for Materials Research, National Bureau of Standards, Gaithersburg, Maryland 20760); Watson, R.E. Phys. Rev. B 12: No. 11, 5335-5337 (1 Dec 1975).

Pt-site Knight shifts for the alloy system $LaCu_{5-x}Pt_x$ ($0 < x \leq 5$), and x-ray photoemission data for Pt, $LaNi_5$, and $LaPt_5$ are presented. Variation of the electronic structure of La–transition-metal alloys of $CaCu_5$ type with alloying at the transition-metal sites is discussed in the light of these results and earlier data on the $LaNi_{5-x}Pt_x$ system.

17782 STUDY OF TUNNELING IN SUPERCONDUCTING INDIUM—TIN ALLOYS. Galkin, A.A.; Svistunov, V.M.; Revenko, Yu.F.; Mostovoi, V.M. (Donets Institute of Physics and Engineering, Academy of Sciences of the Ukrainian SSR). Sov. Phys.—Solid State 17: No. 5, 968-969 (May 1975).

The tunnel effect in the α phase of In-Sn alloys is studied. The dependence of the critical temperature and the energy gap on the impurity concentration is investigated. The phonon spectrum is also reported. (AIP)

17783 THERMOELASTIC ANOMALIES OF THE SPECIFIC HEAT IN THE FCC—HCP PHASE TRANSFORMATION IN YTTERBIUM. Polovov, V.M.; Maistrenko, L.G. (Institute of Solid State Physics, Academy of Sciences of the USSR, Chernogolovka). Sov. Phys.—Solid State 17: No. 5, 1000-1001 (May 1975).

The temperature dependence of the specific heat and electrical resistivity of Yb is studied in the phase-transformation range, 80–450°K. (AIP)

17784 SPECIFIC HEAT OF YTTRIUM, LANTHANUM, AND PRASEODYMIUM AT HIGH TEMPERATURES. Novikov, I.I.; Mardykin, I.P. (A. A. Baikov Institute of Metallurgy, Academy of Sciences of the USSR). High Temp. 13: No. 2, 293-297 (Mar 1975).

We report results of the experimental investigation of the specific heat of lanthanum and praseodymium in the temperature range 1200–1600°K. These results have been obtained based on the use of one of the varieties of regular thermal regimes of the third kind—the method of radial temperature waves—for studying a group of thermal properties (specific heat, thermal diffusivity, and thermal conductivity) of metals in the solid and liquid state. The high-temperature values of the specific heat of solid lanthanum, praseodymium, and yttrium have been analyzed from the point of view of existing approaches in the theory of specific heats. The anomalously large values of the specific heat at constant pressure for the elements of the lanthanum series are due to the large contribution of electrons. (auth)

17785 SUPERCONDUCTORS. Matthias, B. T. (Univ. of California, San Diego). J. Less-Common Met.; 43: No. 1/2, 1-3(1975).

Ernst Raub's comprehensive work on phase diagrams and metallurgy has been decisive for many experimental results in the field of superconductivity. A brief review of this work is given. (auth)

17786 MAGNETIC PROPERTIES OF Gd_7Rh_3. Loebich, O. Jr. (Forschungsinstitut fuer Edelmetalle und Metallchemie, Schwaebisch Gmuend, Ger.); Raman, A. J. Less-Common Met.; 43: No. 1/2, 89-92(1975).

Measurements of the magnetic properties of Gd_7Rh_3 by the Faraday technique between 100 and 800°K on samples of a weak, fibrous texture showed orientation-dependent antiferromagnetic ordering at 142 ± 1°K. Above 470°K, normal Curie–Weiss behavior was observed corresponding to the effective moment of tripositive gadolinium, with $\theta_p = 175 \pm 7$°K. (auth)

17787 MAGNETIC INTERACTIONS IN INTERMETALLIC COMPOUNDS. Buschow, K. H. J. (Philips Research Labs., Eindhoven, Netherlands). J. Less-Common Met.; 43: No. 1/2, 55-67(1975).

The magnetic interactions in intermetallic compounds containing 4f or 3d electrons are discussed. The magnetism of rare-earth intermetallic compounds can adequately be described by the RKKY model. An evaluation of the validity of this model is given by means of experimental data presented for the compounds Gd_2Al, Gd_3Al_2, $GdAl_2$, GdPdIn, and GdCuAl, together with the changes in the magnetic properties observed when Gd is gradually replaced by La, Y (no change in conduction electron concentration) or by Th (increase of the conduction electron concentration). In $GdAl_2$ it also proved possible to replace Gd by non-magnetic Yb, which decreases the conduction electron concentration. The magnetic properties and the magnetovolume effects of various intermetallic compounds of Fe, Co, and Ni, with the rare earth, Y or Th are discussed in terms of a model involving itinerant 3d electrons. (auth)

17788 NEW METHOD OF PRODUCING SUPERCONDUCTING MATERIAL. Khan, H. R.; Raub, C. J. (Forschungsinstitut fuer Edelmetalle und Metallchemie, Schwaebisch Gmuend, Ger.). J. Less-Common Met.; 43: No. 1/2, 49-54(1975). (In German).

A method for producing ductile Cu-based material with incorporated A15 phases is described. The transition temperature of this composite material is close to that of the pure A15 phase. The composites can be reduced, by cold-working, by more than 90%. The results are discussed in the light of other investigations on two-phase alloys. (auth)

17789 MOESSBAUER EFFECT AND MAGNETIZATION MEASUREMENTS IN Eu-Sn COMPOUNDS. Loewenhaupt, M. Berlin; Freie Univ. (1972). 45p. (In German). INIS.

Thesis.

Moessbauer effect and magnetization measurements were carried out on the intermetallic system $Eu_xYb_{1-x}Sn_3$ in the concentration region $0 \leq x \leq 1$. The magnetic properties of the system are only determined by europium. The system has the same crystal structure in the whole concentration region and is antiferromagnetic. The concentration dependence of the paramagnetic Curie temperature, order temperature and of the hyperfine fields on tin and europium are discussed in the light of the RKKY theory. A report is given on the temperature dependence of the hyperfine fields on tin and europium and on magnetization measurements for the compounds Eu(Si,Ge,Sn) and Eu(Si,Ge). (DE)

17790 APPLICATION OF ALLOY 800 IN PWRs. Stieding, L. (Kraftwerk Union AG, Erlangen, Ger.). pp 345-347 of Status Review of Alloy 800. Pugh, S. F. (ed.). London; British Nuclear Energy Society (1975).

From proceedings of a British Nuclear Energy Society; Reading, UK (25 Sep 1974).

Alloy 800 has been used by Siemens since 1968 and is now used by KWU for U-tubed steam generators in PWR's. The particular grade of alloy 800 that is used is within the ASTM-Specification B 163, but there have been modifications in composition to improve the corrosion resistance. First the permitted upper limit of carbon was reduced to 0.04% and was then further reduced to 0.03% and a stabilization ratio of Ti : C ≥ 12 and Ti : C + N ≥ 8 was specified. The minimum permitted chromium and nickel levels were increased to 20% and 32% respectively. The maximum permitted levels of other elements or impurities were reduced. At the final fabrication stage peening with glass beads on the outer surface was specified to introduce a compressive stress to a depth greater than that allowed for production flaws. An account is given of the behavior of the alloy in service in four power plants already in operation, and future developments are discussed. (auth)

17791 INFLUENCE OF GERMANIUM ADDITIONS TO COPPER–TIN SOLID-SOLUTIONS ON THE DIFFUSION PROCESS DURING FORMATION OF Nb_3Sn-A 15 PHASES AND THEIR SUPERCONDUCTING PROPERTIES. Zwicker, U.; Mueller, G.; Boehm, W.; Hofmann, U. (Univ. Erlangen-Nuernberg, Erlangen, Ger.). J. Less-Common Met.; 43: No. 1/2, 33-48(1975). (In German).

Copper-rich alloys of the ternary system copper–germanium–tin were investigated to determine the equilibrium phase diagrams at 700 and 750°C. Alloys suitable for cold and hot forming for making composite materials between these copper alloys and niobium were selected. By annealing the composite materials between 700 and 790°C, an intermetallic compound containing the A 15-phase was produced. The transition temperature and the critical current flow of the Nb_3Sn layers show that both values can be increased by the addition of 0.5% germanium to a CuSn15 alloy. In composite materials of alloys with a content of germanium higher than 0.5%, the intermetallic compound of the A 15 phase (Nb_3Ge) prohibits the formation of the A 15 intermetallic compound Nb_3Sn. The critical current of the pure Nb_3Sn-diffusion layer is much less than that of the Nb_3Sn layer containing germanium. (auth)

17792 YTTERBIUM–PLATINUM SYSTEM. Iandelli, A.; Palenzona, A. (Univ., Genoa). J. Less-Common Met.; 43: No. 1/2, 205-209(1975).

The ytterbium–platinum system has been studied using differential thermal analysis for the alloys up to 45 at.% Pt, and micrographic and x-ray methods over the whole range of composition. Eight intermediate phases are formed, with the compositions: Yb_5Pt_2, Yb_2Pt, Yb_5Pt_3, Yb_5Pt_4, $YbPt$, Yb_3Pt_4, $YbPt_2$, and $YbPt_3$, and their crystal structures have been determined. Little solid

solubility exists for $YbPt_3$ or for ytterbium in platinum. From preliminary magnetic measurements, Yb behaves as a divalent element in Yb_5Pt_2; in the others it is partially or wholly trivalent. (auth)

17793 ENTROPIES OF TRANSFORMATION AND FUSION OF THE METALLIC ELEMENTS. Gschneidner, K. A. Jr. (Ames Lab., IA). J. Less-Common Met.; 43: No. 1/2, 179-189(1975).

The entropy of transformation of metals which possess two or more of the common metallic structures and the entropy of fusion of metals which have one of these structures prior to melting were analyzed. It is concluded that both entropies are dependent upon the crystalline structure of the phases involved and the number of valence electrons, except for transitions between the close-packed structures, hcp → fcc and dhcp → fcc for which the entropy of transformation is apparently only structure dependent. Application of these correlations enabled the prediction of the entropies of fusion for 16 metals and the entropies of transformation for 5 metals for which no reliable experimental data exist. (auth)

17794 X-RAY DIFFRACTION STUDIES OF SOME YTTRIUM–SAMARIUM ALLOYS. Harris, I. R.; Raynor, G. V. (Birmingham Univ., Eng.). J. Less-Common Met.; 43: No. 1/2, 147-155(1975).

The room-temperature lattice spacings of some yttrium–samarium alloys have been determined by Debye–Scherrer, x-ray diffraction measurements. In the composition range 0 to 90% Sm, the diffraction data indicate that the alloys have the cph structure, and extrapolation to 100% Sm gives an axial ratio (c/a) of 1.5916 for a hypothetical room temperature, cph form of samarium. This axial ratio is compared with the general variation of c/a with the atomic number, Z, (or mean atomic number, Zm) of the rare-earth metals and alloys. (auth)

17795 CRYSTAL STRUCTURE OF R. E.–Ni_4Au COMPOUNDS AND UNIT-CELL CONSTANTS IN THE YCo_5–YNi_5–YCu_5 SERIES. Dwight, A. E. (Northern Illinois Univ., DeKalb). J. Less-Common Met.; 43: No. 1/2, 117-120(1975).

Crystallographic studies by the Debye–Scherrer method have shown solid solubility from YCo_5 to YNi_5 to $YNiCu_4$, with the $CaCu_5$-type structure. The compounds YNi_4Au and $GdNi_4Au$ to $LuNi_4Au$ exist with the $MgSnCu_4$-type structure, cF24, $F\bar{4}3m$. (auth)

17796 INFLUENCE OF RARE EARTH METALS AT CONCENTRATIONS BETWEEN 0.03 AND 0.4% ON THE CONDUCTIVITY OF COPPER AT 4.2°K. Krajewski, W.; Winterhager, H. (Institut fuer Metallhuettenwesen und Elektrometallurgie, Aachen). J. Less-Common Met.; 43: No. 1/2, 225-233(1975). (In German).

Binary copper alloys of commercial-grade electrolytic copper with Pr, Nd, Sm, Tb, Dy and Er in the concentration ranges 0.03 to 0.04 and 0.16 to 0.36 wt% have been melted under vacuum. The alloys when strain-free by heating at 350°C for 1 h, show an increase in hardness to 679 N mm^{-2} compared with 517 N mm^{-2} for pure copper; at 4.2°K the specific electrical conductivity fell from 5550 m Ω^{-1} mm^{-2} to 5318 m Ω^{-1} mm^{-2}(Sm), and to 4685 m Ω^{-1} mm^{-2}(Tb) over the concentration range 0.03 to 0.04 wt% rare earth, and to 3541 m Ω^{-1} mm^{-2}(Pr) and 1452 m Ω^{-1} mm^{-2}(Dy) over the concentration range 0.16 to 0.36 wt%. (auth)

17797 ASPECTS OF ELECTROCHEMISTRY, CHEMISTRY, PHYSICS, AND APPLICATIONS OF "LESS-COMMON METALS' Baba, N. (Tokyo Metropolitan Univ.). J. Less-Common Met.; 43: No. 1/2, 295-301(1975).

Chemistry, electrochemistry and physical properties of the less-common metals and their compounds are reviewed in connection with, surface treatments of the so called valve metals (Ta, Nb, Hf, Zr and W), their applications in electronic industries (opto-electronics and electronic ceramics such as ferro-magnetic and ferro-electric substances), fuel cells and solid-state electrolytes containing the rare-earth metal oxides. These applications are now a most promising field in chemical or electrochemical industry. (auth)

17798 ELECTRON ENERGY-LOSS SPECTROSCOPY: APPLICATION TO THE STUDY OF OXYGEN CHEMISORPTION ON THE (100) FACE OF MOLYBDENUM. Lecante, J.; Ballu, Y. J. Phys. (Paris), Lett.; 35: No. 12, L261-L264(Dec 1974). (In French)

Spectra are reproduced showing the energy distribution of 60-eV electrons reflected from the (100) face of clean Mo, from the same surface after exposures of 0.3 to 5 torr. s to O, and after oxidation at 1300°K in O at 10^{-6} torr. Transformations are observed which agree well with those found by photon-emission studies of similar surfaces. The results of determinations by the two methods on the W–O, W–CO, Mo–Co, and Ni–O systems are summarized and shown to be in good agreement. (Metals Abstr.)

17799 MAGNETIC PROPERTIES OF SINGLE CRYSTALS OF $GdCo_2$, $HoNi_2$, AND $HoCo_2$. Gignoux, D.; Givord, F.; Lemaire, R. (CNRS, Grenoble, France). Phys. Rev.; 12B: No. 9, 3878-3884 (1 Nov 1975).

Magnetic measurements performed on single crystals of the $GdCo_2$, $HoNi_2$, and $HoCo_2$ Laves phases lead to a quantitative analysis of the crystal-field effects on energy and magnetization anisotropies. The anisotropy due to cobalt is negligible. Crystal-field parameters were determined from the magnetization variation in intense magnetic fields. The change of easy magnetization direction observed at 14°K on $HoCo_2$ corresponds to a change, with temperature, of the level scheme of the $^5J_8$ ground-state multiplet. An entropy discontinuity is associated with this transition, leading to a specific-heat anomaly. For $HoCo_2$, the values of the anisotropy constants at 0°K are K_1 equals -10^7 erg/cm^3 and K_2 equals 10^9 erg/cm^3. Interactions in $HoNi_2$ are weak compared to crystal-field effects; when a magnetic field is applied, the anisotropy increases so much that it is no longer possible to measure it. (auth)

17800 ANOMALOUS BEHAVIOR OF THE PARAMAGNETIC RESONANCE g SHIFT OF THE Gd^{3+} ION IN Pd/sub 0.96/Gd/sub 0.02/Sm/sub 0.02/. Malik, S. K.; Vijayaraghavan, R. (Tata Inst. of Fundamental Research, Bombay). Phys. Rev.; 12B: No. 9, 3971-3972(1 Nov 1975).

It is suggested that the anomalous behavior of the additional paramagnetic-resonance g shift of the Gd^{3+} ion arising due to the presence of samarium in $Pd_{0.96}Gd_{0.02}Sm_{0.02}$ can be understood on the basis of crystal-field effects on Sm^{3+} ion. (auth)

17801 CONTRIBUTIONS TO LOCALIZED MOMENTS IN TRANSITION AND RARE-EARTH ALLOYS. Yao, Y. D. Potsdam, NY; Clarkson Coll. of Tech. (1974). 264p. University Microfilms Order No. 75-16,943.

Thesis (Ph. D.).

This thesis presents a historical review of the resistance anomaly due to the formation of localized moments in transition and rare-earth alloys. New experimental data are reported on measurements of the electrical resistivity of Ni-rich Ni–Cr alloys, as well as the electrical resistivity and the magnetic susceptibility of Pd-rich Pd–Ce alloys. Some theoretical models (the dilutionization treatment model and the temperature-dependent localized moment model) and theories (such as the magnetic interaction theory for Ni–Cr alloys) are developed in order to obtain a better understanding of the localized moments in transition and rare-earth alloys. Utilizing these models and theories, experimental data can be explained quite well. (Diss. Abstr. Int., B)

17802 EFFECTS OF BISMUTH IMPURITIES IN LOW CONCENTRATIONS UPON THE CRITICAL FIELD CURVE OF SUPERCONDUCTING TIN BELOW 1K. Barnes, J. E. Clemson, SC; Clemson Univ. (1975). 75p. University Microfilms Order No. 75-22,085.

Thesis (Ph. D.).

The critical magnetic field curves of several bismuth-doped samples of superconducting tin were determined at temperatures less than 1°K. Measurements were made in a ^{3}He refrigerator. A technique was used for detecting the transition between the superconducting and normal states. Results are compared to the theoretical work of Clem for the removal of the gap anisotropy of a pure superconductor with the addition of small concentrations of nonmagnetic impurities which should result in a reduction of the critical field at the absolute zero of temperature H_0. The changes in H_0 (DELTA H_0) with impurities found in this work are larger than can be attributed to just the removal of the anisotropy of the energy gap at lowest impurity concentrations. It is assumed that DELTA H_0 is composed of two factors reducing H_0 at low impurity concentrations, anisotropy and valence effects. It is concluded that the valence effects must be a nonlinear function of impurity concentrations. This is in variance with the previous work of others where it is assumed that the valence effects vary linearly with impurity concentration. However, the previous work does not examine the experimental quantities measured in this work at very low impurity concentrations. (Diss. Abstr. Int., B)

17803 THERMODYNAMIC ASSESSMENT OF THE FUNDAMENTALS OF INTRA-RARE-EARTH ALLOYING BEHAVIOR. Lundin, C. E. Denver; Univ. of Denver (1975). 200p. University Microfilms Order No. 75-23,383.

Thesis (Ph. D.).

The alloying behavior of a logical progression of four intra-rare-earth binary systems was evaluated systematically. Experimental techniques allowed establishment of the phase equilibria, the atomic structural characteristics, the deviation from solution ideality, and the free energies, enthalpies, and entropies of mixing of each binary system. The specific techniques were thermal analysis, metallography, x-ray diffraction analysis, and Knudsen effusion analysis. The parameters considered were electronic structure, crystal structure, atomic diameter, valence, and electronegativity. The first system, Pr–Nd, was chosen with no component variables. All of the parameters of Pr and Nd were essentially the same. The system was found to behave as an ideal solution. The next system, Sm–Gd, was selected with a crystal

structure difference in the components. All other parameters of the components were constant. The binary solution exhibited a negative deviation from solution ideality, which indicated ordering of the atoms. The third system, Gd–Y, was selected to study the effect of the electronic structure difference. The binary mixing of components resulted in the formation of another ideal solution. The fourth system, Y–Sm, combined the variables of the second and third systems. These were the electronic structure and crystal structure. All other parameters were constant. The mixing of the components in the solution resulted again in a negative deviation from solution ideality indicating a tendency toward ordering of the atoms. (Diss. Abstr. Int., B)

17804 INVESTIGATION OF HYDROGEN CHEMISORPTION ON THE TUNGSTEN (100) SURFACE. Withrow, S. P. Urbana, IL; Univ. of Illinois (1975). 195p. University Microfilms Order No. 75-24,442.

Thesis (Ph. D.).

Work function measurements, Auger electron spectroscopy, electron stimulated desorption (ESD) of ions, low energy electron diffraction, and electron scattering energy loss measurements were used to investigate chemisorption of hydrogen on a single crystal tungsten (100) surface over a temperature range from 60^0 to -150^0C. Auger spectroscopy indicate that heating the crystal to 2200^0K cleans the surface of carbon and oxygen. However, weak structure is observed between 475 eV and 520 eV, and possible sources of this structure are considered. Work function changes observed at both 60^0C and -150^0C as a function of exposure to hydrogen are equivalent within experimental error. The full monolayer changes in work function with hydrogen adsorption are 0.98 eV and 0.92 eV at the two temperatures, respectively. Cooling the clean surface from 220 to -150^0C increases the work function approximately 0.05 eV. Hydrogen ions are desorbed from the dosed tungsten surface following electron impact. The distribution in energy of these ions has a Gaussian line shape, with a peak intensity at an ion energy of 3.0 eV and a full width at half maximum of 2.6 eV. LEED pattern changes, observed as a function of hydrogen coverage, are in good agreement with results published in the literature. The intensity of the c(2 x 2) pattern associated with the $beta_2$ hydrogen state maximizes at a work function change with adsorption of 0.15 eV. LEED elastic intensity profiles have been obtained for several low index beams. A c(2 x 2) LEED pattern is obtained if the crystal is cooled below room temperature. No significant bulk to surface diffusion of hydrogen was found. No evidence was found from work function and electron scattering experiments to support the hypothesis that the low temperature, c(2 x 2) pattern results from hydrogen on the surface. In addition, the fast hydrogen state is not believed to be responsible for the c(2 x 2) pattern. Electron scattering energy loss spectra were obtained as a function of hydrogen coverage for loss energies of 0 eV less than or equal to w less than or equal to 40 eV. Hydrogen adsorption has a marked effect on the spectra. Fine structure in the data is discussed and compared to photoemission data. Cooling the clean crystal below room temperature causes only a slight change in the energy loss spectrum. (Diss. Abstr. Int., B)

17805 MICROPLASTICITY IN VANADIUM SINGLE CRYSTALS. Crowe, C. R. Jr. College Park, MD; Univ. of Maryland (1975). 175p. University Microfilms Order No. 75-23,726.

Thesis (Ph. D.).

This work focuses on the flow behavior in the microstrain region. A major objective is to examine by thermal activation analysis whether a single dislocation mechanism controls the rate of deformation at all strains and temperatures, or whether different dislocation processes control the flow rate in the microstrain region. An investigation of the activation parameters for plastic deformation in the microstrain region was performed. Vanadium single crystals with (491) axial orientations were tested in compression by strain rate cycling at various intervals over the strain range of 1×10^{-5} to 2×10^{-3} at a strain sensitivity of 5×10^{-7}. Tests were conducted between 125 and 300^0K on a series of crystals containing interstitial solute concentrations in the range 486 to 1649 at. ppm oxygen plus nitrogen content. Results indicate that in the microstrain region more than one dislocation process is occurring. The results are consistent with the theory that edge and nonscrew dislocations are the mobile species in the microstrain region at low temperatures. As deformation proceeds, the mobile densities of the edge and nonscrew segments decreases and the transition to macroflow is associated with the onset of screw dislocation motion. The data indicate that in the microstrain region, edge and nonscrew dislocation mobility is strongly affected by solute interactions. In the macrostrain regions, however, flow rate is apparently controlled by screw dislocation-lattice interactions. (Diss. Abstr. Int., B)

17806 LOCAL ATOMIC ARRANGEMENTS AND SOLUTION STRENGTHENING OF Ta–Mo AND Ta–Nb ALLOYS. Predmore, R. E. College Park, MD; Univ. of Maryland (1975). 81p. University Microfilms Order No. 75-23,731.

Thesis (Ph. D.).

Ta–Nb alloys are shown to form random solid solutions by x-ray diffuse scattering measurements. These alloys have equal size atoms in their pure state with lattice parameters that are invariant in composition, obey Vegard's Law, and exhibit an absence of solid-solution hardening and an absence of fracture embrittlement at high solute concentrations. Ta–Mo atoms of about 5 percent difference in atomic size form short-range ordered, solid solutions with large atomic displacement effects. The Ta–Mo, and Ta–W, Nb–Mo, and Nb–W alloys have in common a lattice parameter that varies in composition with a negative deviation from Vegard's Law. There is also a negative heat of mixing which is well correlated with short range order. In addition, all these alloys show linear solid solution hardening to high solute concentrations at room temperature and fracture embrittlement at high solute concentrations. Diffuse x-ray scattering measurements on Ta–Mo alloys give the short-range order parameters and atomic size displacements. The hardening is attributed to a combination of size effect induced substitutional solid-solution hardening and short-range-order-induced hardening. (Diss. Abstr. Int., B)

17807 MAGNETOACOUSTIC ATTENUATION IN SINGLE CRYSTAL BERYLLIUM. Vozenilek, E. F. University Park, PA; Pennsylvania State Univ. (1975). 106p. University Microfilms Order No. 75-22,717.

Thesis (Ph. D.).

Quantum oscillations in the magnetoacoustic absorption in beryllium were observed in magnetic fields up to 100 kOe, and at sonic frequencies from 200 MHz to 1.85 GHz, at 1 kelvin. Areas of extreme cross section of the Fermi surface were derived from this data and were found to be in agreement with de Haas–van Alphen data reported by others. Comparison of these areas was made to existing pseudopotential theory of the Fermi surface for Be. For anti H along the [0001] direction, a coupled orbit, attributed to magnetic breakdown between the cigar and coronet, was observed. The relative amplitudes of the magnetoacoustic quantum oscillations from two nearly equally sized extremal areas ("waist" and "hips") of the cigar in the Fermi surface of Be, with anti H parallel [0001], were found to be dependent on both the propagation direction of the sound, and the propagation mode; i.e., shear or longitudinal. Quantum oscillations in the shear wave acoustic absorption were not detectable for sonic frequencies greater than or equal to 750 MHz, in spite of improved signal-to-noise at these frequencies. Magnetoacoustic geometric resonances, which give caliper dimensions of the Fermi surface, were observed at frequencies from 500 MHz to 1.85 GHz with longitudinal sound and with the specimen at 1 kelvin. Caliper dimensions of the coronet in the [10 anti 10] direction of the basal plane are in good agreement with theory. An upper limit is obtained for the dimension of the coronet in the [11 anti 20] directions. The cigar was calipered in the (10 anti 10) plane at angles between anti H and [0001] up to 55^0. Evidence is given supporting the theoretical triangular cross section of the cigar. (Diss. Abstr. Int., B)

17808 AGING BEHAVIOR AND STRENGTHENING MECHANISMS IN Ti–6Al–2Sn–4Zr–6Mo ALLOYS. Young, M. S. S. Brooklyn; Polytechnic Inst. of New York (1975). 124p. University Microfilms Order No. 75-21,411.

Thesis (Ph. D.).

In Ti–6Al–2Sn–4Zr–6Mo alloys, beta transforms to orthorhombic martensite when quenched from a temperature of 915^0C or above. X-ray analysis showed that aging at 500 or 600^0C gradually reduces the degree of orthohombicity until a hexagonal structure equivalent to alpha, but having the morphological characteristics of the prior martensite, is produced. The orthorhombicity is reduced by solute rejection to beta which forms as particles both homogeneously and heterogeneously with the martensite structure. The structure at maximum hardness is a fine distribution of Burger's oriented beta particles in a matrix of martensite of greatly reduced orthorhombicity. Overaging appears to occur as a result of coarsening of the homogeneous beta particles. Aging at temperatures from 600 to 810^0C results in growth of one particular variant of the beta which is located at the interface between twin related regions composing a martensite lath. This beta along with similarly oriented beta at lath interfaces forms a continuous beta matrix by a gradual growth process. It is shown that this matrix has the identical orientation and shape of the original beta grain prior to quenching. A mechanism is proposed to account for this memory effect. When quenched from 850^0C, the resulting structure is a mixture of eqiaxed alpha + retained beta phases. Slip was found to be the only deformation mode and was extremely heterogeneous in nature for the as-quenched structure. Dislocations were found at the leading edge as well as in the vicinity and inside the precipitated alpha. With aging

a plate-like alpha structure gradually transforms the retained beta into a basket weave structure and the slip characteristics change from heterogeneous to homogeneous both in the primary alpha and the aged beta structure. (Diss. Abstr. Int., B)

17809 MAGNETOSTRICTIVE ULTRASONIC GENERATION IN RARE-EARTH-IRON THIN FILMS. McLane, L. B. Houston, TX; Rice Univ. (1975). 153p. University Microfilms Order No. 75-22,040.

Thesis (Ph. D.).

Ultrasonic elastic waves were magnetostrictively generated in polycrystalline thin films of terbium and iron in various proportions. $TbFe_2$ has been the composition of principal interest with lesser attention being given TbFe, $TbFe_3$, and $Tb_{0.3}Dy_{0.7}Fe_2$. High efficiencies, more than 100 times greater than with surface piezoelectric generation in quartz, have been achieved in these films at room temperature. All data were taken at 690 MHz. Certain of the $TbFe_2$ films were discovered to have a strong magnetic anisotropy with the easy axis of magnetization perpendicular to the plane of the film. This anisotropy led to coercive forces as large as 6 kOe and remanent magnetizations of the order of 80 percent of their saturation values. As a consequence these films retained their effectiveness as ultrasonic transducers in the absence of an external dc biasing field. A study of the effects of film thickness and various deposition parameters on these phenomena was studied and considerable attention is given to a description of the deposition apparatus and procedure. A qualitative theoretical explanation of the magnetoelastic generation effect is developed, though necessarily limited by the current level of understanding of rare-earth compounds. (Diss. Abstr. Int., B)

17810 SUPERCONDUCTIVITY OF VANADIUM-BASED ALLOYS. Pendrys, L. A. Rochester, NY; Univ. of Rochester (1975). 126p. University Microfilms Order No. 75-22,770.

Thesis (Ph. D.).

Superconductivity of binary alloys spanning the stoichiometric compounds V_3Si, V_3Ge, V_3Ga, and V_3Al was surveyed by studying samples prepared by rf co-sputtering from alloy cathodes. Surveys were also made of pseudo-binary alloys between the above compounds. Nearly bulk values of the superconducting transition temperature, T/sub c/, were obtained for V_3Si, V_3Ga, and V_3Ge. X-ray diffraction studies showed that the A-15 phase of V_3Al was formed. A maximum T/sub c/ of 11.7°K was obtained for this compound. X-ray studies also showed that Vergard's law applies to these pseudo-binary systems and that new V_3Al-rich pseudo-binary alloys were formed with V_3Si, V_3Ga, and V_3Ge. Trends of T/sub c/ in the pseudo-binary systems indicate that the T/sub c/ of pure single-phase A-15 V_3Al probably does not exceed 12°K. The importance of sputtering conditions, especially the substrate deposition temperature, for forming V_3Al and V_3Ga properly was observed. Disorder in some samples evidently depressed the transition temperature, but the variation of T/sub c/ as a function of composition of pseudo-binary systems was attributed to a variation in the density of states at the Fermi level caused by changes in the V-atom spacing and the electron transfer of the nontransition components. It was concluded that details of the latter effect require a chemical understanding. (Diss. Abstr. Int., B)

17811 ULTRASONIC INVESTIGATIONS OF THE JAHN–TELLER EFFECT. Mullen, M. E. New Brunswick, NJ; Rutgers–the State Univ. (1975). 188p. University Microfilms Order No. 75-17,464.

Thesis (Ph. D.).

Several transition metal (i.e., Ni/sub x/Zn/sub 1 - x/Cr_2O_4 and $CsCuCl_3$) and rare earth (lanthanum antimonides, TmCd, Pr metal) compounds were investigated ultrasonically, the changes in sound velocity being used as a probe. The coupling of the ultrasonically produced strain field to the energy levels of the transition metal and rare earth ions (a manifestation of the Jahn–Teller effect) causes readily discernible changes in the sound velocity. Three general types of behavior are noted as the temperature is changed. If the coupling between the strain and the energy levels is vanishingly small, or if the ground state multiplet is a singlet or Kramer's doublet (which cannot be split by a strain), the usual behavior of a solid is seen, that is, the velocity increases as the temperature is lowered, and becomes constant at temperatures near absolute zero. If the lowest level of the ground state multiplet is a singlet or Kramer's doublet, and the coupling constant is less than some critical value, there is a minimum in the velocity vs. temperature curve, at a temperature which is related to the energy of the lowest excited state. If the ground state is a singlet or Kramer's doublet, and the coupling is above the critical value, or if the lowest level is a multiplet other than a Kramer's doublet, there exists a temperature below which the crystal distorts. Studies of the velocity anisotropy in nematic and cholesteric liquid crystals, nematic-isotropic and cholesteric-nematic phase transitions were performed in conjunction with the investigations and are also reported. (Diss. Abstr. Int., B)

17812 CRITICAL TEMPERATURES OF THIN ALUMINUM AND LEAD SUPERCONDUCTING FILMS. Johnson, A. C. New Orleans; Tulane Univ. (1975). 85p. University Microfilms Order No. 75-23,279.

Thesis (Ph. D.).

The critical temperatures of thin superconducting Al and Pb films were measured resistively. The Al films were evaporated from Al_2O_3 boats onto cold substrates (approximately 4.5°K) of z-cut crystalline quartz and poly(n-vinylcarbazole) (PVK). The maximum T/sub c/ for Al films on quartz was 5.3°K. Al films on PVK show less enhancement of T/sub c/ than the films on quartz. The Pb films were evaporated onto cold substrates (4.5° and 77°K) of z-cut crystalline quartz, epitaxially grown PbTe, and amorphous PbTe. Films were also formed by coevaporation of Pb and PbTe. Depressed T/sub c/'s were observed for very thin Pb films in close contact with PbTe. No evidence of a superconducting state in pure PbTe was observed. Results may be understood within the framework of existing phonon-induced superconductivity theories and are in general agreement with trends observed by other investigators. (Diss. Abstr. Int., B)

17813 STUDY OF NaTl-TYPE I/sub a/III/sub b/ Li COMPOUNDS PREPARED BY THE SANDWICH-TYPE EVAPORATION METHOD. Kezuka, H.; Iwamura, K. (Hosei Univ., Tokyo). Thin Solid Films; 30: No. 1, 11-17(Nov 1975).

Films of the I/sub a/III/sub b/ intermetallic compounds LiAl and LiIn were deposited by the sandwich-type evaporation method. The method involves evaporating I/sub a/ and III/sub b/ atoms in the order III/sub b/ atoms first, I/sub a/ and III/sub b/ atoms second and III/sub b/ atoms last, to prevent Li atoms diffusing into the glass substrate or becoming exposed to the atmosphere (i.e. the codeposited I/sub a/ and III/sub b/ atoms are sandwiched between III/sub b/ atoms). The degree of crystallization of the films was investigated by electron diffraction and electrical resistance measurements during annealing. Films of LiIn compound were obtained when the as-deposited films were annealed at substrate temperatures of 200°C or above, and films of LiAl compound were obtained when films deposited at 350°C were annealed for 90 min or more at the same temperature. The resistivity at room temperature was about 5×10^{-4} OMEGA cm for LiAl films and 2×10^{-5} to 5×10^{-5} OMEGA cm for LiIn films, which is in good agreement with the resistivity of bulk LiIn measured by Mooser and Junod. (auth)

17814 EFFECT OF THICKNESS ON THE ELECTRICAL RESISTIVITY OF DYSPROSIUM FILMS. Kaul, V. K.; Bist, B. M. S.; Srivastava, O. N. (Banaras Hindu Univ.). Thin Solid Films; 30: No. 1, 65-72(Nov 1975).

Electrical resistivity measurements at room temperature on dysprosium films in the thickness range 200–1000 A are described. The observed thickness dependence of the resistivity in the present case is interesting because, in marked contrast with results for other thin films, the resistivity for Dy thin films decreases at lower thicknesses (less than 600 A). Evidence and arguments are advanced to show that this interesting thickness dependence is due to a superimposition of two effects, namely the thickness dependences of the structural phase and of the spin disorder resistivity of Dy thin films. (auth)

17815 SUPERCONDUCTIVITY IN AMORPHOUS AND MICROCRYSTALLINE TRANSITION-METAL ALLOYS. Johnson, W. L.; Poon, S. J. (California Inst. of Tech., Pasadena). J. Appl. Phys.; 46: No. 4, 1787-1792(Apr 1975).

Results of x-ray diffraction, electrical resistivity, critical magnetic field, and transport measurements for several bulk amorphous and microcrystalline transition-metal superconductors obtained by liquid quenching are presented and discussed. Simple J/sub c/-H/sub c2/-T/sub c/ relations are observed for this class of materials. A linear relation between electronic diffusivity and nearest-neighbors distance is derived from critical field measurements. The relationship between the formation of an amorphous phase by rapid cooling from the liquid state, lattice stability, and the characteristics of phase diagrams are discussed. (auth)

17816 PREDICTION OF DIELECTRIC BREAKDOWN IN SHOCK-LOADED FERROELECTRIC CERAMICS. Lysne, P. C. (Sandia Labs., Albuquerque, NM). J. Appl. Phys.; 46: No. 1, 230-232(Jan 1975).

Recent investigations of dielectric breakdown of a poled ferroelectric ceramic suggest that the same mechanisms are active in shock-loading and ambient-condition experiments. Further work described here supported this view for PZT 65/35. Breakdown in

shock-loaded specimens can be predicted from ambient and quasi-static-loading data using the concept of a critical particle energy. The effects of the ferroelectric-to-paraelectric transformation and other factors are discussed for shock-loaded PZT materials. (auth)

17817 OVERLAP INTERACTION BETWEEN SPHEROIDAL IONS AND THE LATTICE DYNAMICS OF ZINC AND BERYLLIUM. Vibhute, D. B.; Verma, M. P. (Agra Coll., India). Phys. Rev., B; 12: No. 10, 4302-4306(15 Nov 1975).

A phenomenological model of lattice dynamics of hcp metals has been developed by assuming the ions to have a spheroidal shape with the axis of revolution parallel to the c axis. Overlap of spheroidal ions causes a noncentral interaction between the first neighbors (as in beryllium). The model is derived from a force system consisting of this noncentral overlap interaction, as six-neighbor central pair potential, and an electron-ion interaction term. Application of this model to zinc and beryllium shows that the force parameters coupling neighbors beyond the second are rather small as compared with the parameters for the first two neighbors. The dispersion curves derived from the model present a good agreement with the experimental curves. (auth)

17818 SUPERCONDUCTING MATERIALS UP TO NOW AND INTO THE FUTURE. Geballe, T. H. (Stanford Univ., CA); Hulm, J. K. IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 119-124(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The first portion of the paper is concerned with the range of intrinsic properties: the critical temperatures (T/sub c/), critical fields (H/sub c/), and critical currents (J/sub c/). In the latter part, the fabrication of superconducting materials into composite wires or cables in forms suitable for producing magnets, generators, transmission lines, and some other devices is discussed. Structures concerned with nonpower-related applications such as Josephson junction devices are beyond the present scope. (auth)

17819 PROPERTIES OF AMORPHOUS AND MICROCRYSTALLINE SUPERCONDUCTORS. Johnson, W. L.; Poon, S. J. (California Inst. of Tech., Pasadena). IEEE Trans. Magn.; MAG-11: No. 2, 189-191(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Results of x-ray diffraction, electrical resistivity, critical field(H/sub c2/) and transport measurements are presented and discussed for bulk amorphous and microcrystalline transition metal alloys (Au–La, Nb–Rh, Nb–Ni–Rh, and Pd–Zr) obtained by liquid quenching. The transition temperature of the alloys is in the range 1.5 to 4.7°K. The J/sub c/–H/sub c2/–T/sub c/ relations are rather simple for this class of material and are compared with the theories of type II superconductors. The high resistance of bulk metallic glass to radiation damage might render them suitable for magnetic field applications in high radiation environments. (auth)

17820 SUPERCONDUCTIVITY IN Nb_3Ge. Gavaler, J. R.; Janocko, M. A.; Braginski, A. I.; Roland, G. W. (Westinghouse Research Labs., Pittsburgh). IEEE Trans. Magn.; MAG-11: No. 2, 192-196(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The recent report that Nb_3Ge films can be prepared with superconducting transition temperatures of over 22K has immediately made Nb_3Ge a very important potential candidate for a variety of large scale applications, such as for example, power transmission lines, or large high field magnets. Short sample data on sputtered films show that Nb_3Ge possesses an extremely attractive combination of high field properties, competitive with any other presently known material at all temperatures from zero to T/sub c/. The development of a process capable of being used to fabricate Nb_3Ge in a useful configuration (i.e., long length of wire or tape) is now being investigated. Chemical vapor deposition (CVD) is a demonstrated commercial process, which may be applicable for this purpose. Initial CVD studies have yielded films with T/sub c/'s over 21.5°K. (auth)

17821 SPUTTERED FILMS. Testardi, L. R. (Bell Telephone Labs., Murray Hill, NJ). IEEE Trans. Magn.; MAG-11: No. 2, 197-200(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

New metallurgical phases and enhanced superconductivity can be obtained using hot substrate sputtering. Some advantages and limitations of this technique are discussed. For Nb–Ge, studies of T/sub c/, resistivity, crystallographic structure, compositional dependences, and impurities are summarized. Although T/sub c/ varies with composition it is not found to be critically dependent upon exact stoichiometry and, at the same composition, is considerably higher in the films than in the bulk. A simple correlation between T/sub c/ and resistance ratio is reported. (auth)

17822 SUPERCONDUCTING, METALLURGICAL AND SYNTHESIS PROPERTIES OF Nb_3Ga. Webb, G. W.; Engelhardt, J. J. (Univ. of California, San Diego, La Jolla). IEEE Trans. Magn.; MAG-11: No. 2, 208-213(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A review is presented of the superconducting, metallurgical, and synthesis properties of Nb_3Ga which are important for its potential application. The superconducting properties discussed are T/sub c/, H/sub c2/(T), and the dc critical current J/sub c/(H). Special metallurgical features of the Nb–Ga system which put severe constraints on synthesis techniques of potential practical importance for this material are discussed. Superconductivity data for materials synthesized by the techniques of quenching and annealing, chemical vapor deposition, and vacuum co-evaporation are reviewed. Recent results on the effects of radiation damage and its recovery by annealing are reviewed. (auth)

17823 BULK SUPERCONDUCTIVITY ABOVE 20 K IN Nb_3Ge. Newkirk, L. R.; Valencia, F. A.; Giorgi, A. L.; Szklarz, E. G.; Wallace, T. C. (Los Alamos Scientific Lab., NM). IEEE Trans. Magn.; MAG-11: No. 2, 221-224(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The superconducting properties of bulk films (0.02 to 0.06 mm thick) of Nb_3Ge deposited on Cu substrates by chemical vapor deposition were studied along with physical parameters characterizing these deposits. Results of susceptibility measurements showing superconducting onsets greater than 21°K and resistivity measurements showing onset greater than 22°K are presented along with heat capacity measurements. Data are also presented defining a relationship between superconducting transition temperature and lattice spacing throughout the range of 4 to 21°K. In addition, the effects of substrate temperature and substrate material, as well as mechanical properties such as substrate adherence, are described. (auth)

17824 STUDIES ON THE MULTIFILAMENTARY V_3Ga WIRE. Tachikawa, K.; Itoh, K.; Tanaka, Y. (National Research Inst. for Metals, Tokyo). IEEE Trans. Magn.; MAG-11: No. 2, 240-242 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The stability of the multifilamentary (MF) V_3Ga wire under pulsed excitation and the effect of aluminum addition to the Cu–Ga alloy matrix were investigated. Small coils wound by the MF V_3Ga wire and by a similar MF Nb–Ti wire were excited with a speed ranging 0.5 to 200 kOe/s. The critical current of the MF V_3Ga wire coil does not degrade up to an exciting speed as high as 200 kOe/s, while that of the MF Nb–Ti wire coil decreases rapidly in exciting speed higher than 20 kOe/s. The instability phenomena, e.g. flux jumps and training effects are much smaller in the MF V_3Ga wire than in the MF Nb–Ti wire. The addition of aluminum in the Cu–Ga alloy matrix enhances the formation of V_3Ga and increases the critical current. The partial substitution of aluminum for gallium in the Cu–Ga alloy matrix seems to be promising for increasing the current-carrying capacity and decreasing the cost of the wire. (auth)

17825 MULTIFILAMENTARY NIOBIUM TIN MAGNET CONDUCTORS. Larbalestier, D. C. (Rutherford Lab., Chilton, Eng.); Madsen, P. E.; Lee, J. A.; Wilson, M. N.; Charlesworth, J. P. IEEE Trans. Magn.; MAG-11: No. 2, 247-250(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Practical magnet conductors of multifilamentary Nb_3Sn have been produced. Evaluation of these bronze route conductors is described. Conductors studied range from a 1369 filament all-bronze matrix conductor to 5143 and approximately 42,000 filament conductors, containing internal high purity copper protected by diffusion barriers. Filament sizes vary from approximately 3 to 8 mu m diameter. The effect of heat treatment conditions on critical current and transition temperature is presented and it is shown that overall critical current densities greater than those available in niobium titanium can now be produced in multifilamentary Nb_3Sn magnet conductor.

17826 SUPERCONDUCTING PROPERTIES OF V_3Ga COMPOSITE WIRES. Howe, D. C.; Weinman, L. S. (Naval Research Lab., Washington, DC). IEEE Trans. Magn.; MAG-11: No. 2, 251-254(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Studies of the superconducting properties of V_3Ga single filament

composite wires grown by solid state reaction are presented. The three alloy compositions investigated were: V/Cu–15.4 at. percent Ga, V–6.1 at. percent Ga/Cu–15.4 at. percent Ga and V–9.0 at. percent Ga/Cu–17.5 at. percent Ga. Critical currents were measured at 4.2°K in transverse magnetic fields to 175 kG and transition temperature data were obtained by ac mutual inductance techniques for V_3Ga formed at temperatures from 515 to 700°C. Growth rates for V_3Ga were strongly influenced by alloy composition and formation temperature with more rapid growth occurring in composite wires with higher Ga contents. In addition to the more rapid growth rates obtained, a factor of 10 improvement in the critical current density (J/sub c/) also was exhibited in V_3Ga grown at 600°C in the V–9.0 at. percent Ga/Cu–17.5 at. percent Ga composite specimen. The best J/sub c/ observed to date was 10^6 A/cm^2 in a transverse magnetic field of 100 kG for a wire reacted at 550°C. (auth)

17827 FLUX PINNING IN Nb_3Sn MULTIFILAMENTARY CONDUCTORS. Mathur, M. P.; Ashkin, M.; Deis, D. W.; Shaw, B. J. (Westinghouse Research Labs., Pittsburgh). IEEE Trans. Magn.; MAG-11: No. 2, 255-258(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Magnetization measurements on diffused reacted samples were made at several temperatures T, between 4.2°K and T/sub c/ and magnetic fields H up to 75 kOe. The samples were distinguished from each other by different heat treatments and diameter size ranges from 200 to 500 mu m. From these measurements, J/sub c/(H,T) and F/sub p/(H,T) curves were derived, where F/sub p/ is the flux pinning force density. For all samples, F/sub p/(H,T)/F/sub pmax/ (T) vs H/H/sub c2/ needs to be described by two functions, one for T less than 8°K and the other for T greater than 8°K, in contrast to other materials where flux pinning is usually described by a single function. (auth)

17828 EFFECT OF METALLURGICAL HISTORY ON "J/sub c/(5T)" IN SURFACE DIFFUSE MULTIFILAMENTARY Nb_3Sn. McInturff, A. D. (Brookhaven National Lab., Upton, NY); Larbalestier, D. C. IEEE Trans. Magn.; MAG-11: No. 2, 259-262 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Data are presented of critical current density "J/sub c/(5T)" in a 5 T perpendicular magnetic field (and 10 T as well for selected samples) for multifilamentary Nb_3Sn formed by Sn diffusion from a Cu–Nb composite's outer surface. The parameters varied are: composite diameter and Cu/Nb ratio, Sn percentage, filament diameter, reaction temperature, and time. The composite diameter varied from 0.254 to 0.08 mm; Cu/Nb volume ratio from 1.7 to 3; volume percentage of Sn from 2 to 13.8 percent; average filament diameter from 2 microns to 7 microns. The reaction temperature was varied between 550 to 795°C for different lengths of time, one to several thousand hours. A three-stage heat treatment was selected to formulate the basis for the reaction heat treatment map. The J/sub c/(5T) varied from 10^3 to greater than 3×10^5 A/cm^2 over the entire composite cross section (Cu–Sn, Nb_3Sn, Nb). The optimum performances were 38.8 A in 0.127 mm diam 1.9/1 Cu/(Nb + Nb_3Sn) composite at 5 T and 78 A in a 0.18 mm diam 3/1 Cu/(Nb + Nb_3Sn) at 5 T. 12 figures. (auth)

17829 Nb_3Al FORMATION AT TEMPERATURES LOWER THAN 1000°C. Ceresara, S. (ISML, Novara, Italy); Ricci, M. V.; Sacchetti, N.; Sacerdoti, G. IEEE Trans. Magn.; MAG-11: No. 2, 263-265(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A study was made of the possibility of making Nb_3Al wires by interdiffusion between Al and Nb at relatively low temperatures (lower than 1000°C). This method should allow the fabrication of a copper stabilized wire by coworking Nb and Al composites in a copper matrix before the diffusion treatment. Results concerning the diffusion temperature and time dependence of J/sub c/ and T/sub c/ are presented. While J/sub c/(64 kG) is quite high, of the order of 1.5×10^5 A/cm^2, T/sub c/ is 15.56°K, lower than the usually reported value. X-ray measurements of the lattice parameter are also reported and correlated with the measured value of T/sub c/.

17830 RECENT DEVELOPMENTS IN MULTIFILAMENT V_3Ga AND Nb_3Sn WIRES IN JAPAN. Iwasa, Y. (Massachusetts Inst. of Tech., Cambridge). IEEE Trans. Magn.; MAG-11: No. 2, 266-271(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The state of development of multifilament V_3Ga and Nb_3Sn wires in Japan is reviewed with emphasis on the former as it is principally in Japan that V_3Ga has undergone the most intensive development. Commercial sources for these materials are identified. A brief discussion is presented of the effort on commercial development of multifilament V_3Ga wire in the United States.

17831 DUCTILE SUPERCONDUCTING Cu-RICH ALLOYS CONTAINING A-15 FILAMENTS. Tsuei, C. C. (IBM Watson Research Center, Yorktown Heights, NY). IEEE Trans. Magn.; MAG-11: No. 2, 272-275(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A new approach to a ductile composite of Cu and an A-15 superconducting compound has been reported recently. This new metallurgical process consists of melting the constituent elements and subsequent cold-working and heat treatment. The superconducting materials prepared by this technique are composed of about 90 at. percent Cu and a superconducting compound such as Nb_3Sn or V_3Ga which is in the form of fine filaments embedded in the Cu matrix. The new alloy is superconducting at a temperature nearly identical to that of the superconducting phase in bulk form. The current density (J/sub c/) is approximately 10^4 to 10^5 A/cm^2 at 4.2°K and zero magnetic field (J/sub c/ is calculated by taking the total cross section of the specimen). An up-to-date account of the experimental situation in this field is given. The discussion includes (1) the results of varying the alloy composition, the amount of cold-working and the heat treatment; (2) the transition temperature and J/sub c/ of Sn-coated Cu-(Nb_3Sn) wires; (3) J/sub c/ as a function of transverse magnetic field; (4) the phenomenon of J/sub c/ enhancement as a result of mechanical deformation and (5) the basic mechanisms responsible for the observed superconductivity in these new materials. (auth)

17832 REMNANT RESISTANCE IN TSUEI'S COMPOSITE SUPERCONDUCTORS. Davidson, A.; Beasley, M. R.; Tinkham, M. (Harvard Univ., Cambridge, MA). IEEE Trans. Magn.; MAG-11: No. 2, 276-279(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The application of a new superconducting composite wire developed by C. C. Tsuei for high-field, high-current uses is explored. The importance of the discontinuous nature of the superconducting filaments in this material is analyzed. Calculations indicate that practical wire may have a remnant resistivity of 10^{-14} ohm-cm or less and experiments to date are reported in which attempts were made to measure this quantity. Observations of quantum coupling between filaments in this wire are also reported.

17833 FABRICATION AND PROPERTIES OF MULTIFILAMENT Nb_3Sn CONDUCTORS. Randall, R. (Supercon Inc., Natick, MA); Wong, J.; Deis, D. W.; Shaw, B. J.; Daniel, M. R. IEEE Trans. Magn.; MAG-11: No. 2, 291-294(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Multifilament conductors have been fabricated in several configurations employing various combinations of Cu, Sn, Cu–Sn bronze, and Nb. These conductors are in the 8 to 100 mil size range and contain 400 to 13,000 filaments. Filament sizes range from 8 to 100 microns in diameter. Heat treatment studies and their effect upon superconducting properties have been performed for temperatures in the range 600 to 800°C. Sample evaluation has included measurements of T/sub c/, resistivity, and J/sub c/ up to 150 kG. Mechanical tests to assess allowable bending diameters and metallurgical studies to determine the distribution of constituent elements subsequent to heat treatment were made. Results are discussed and compared in the context of optimizing the properties of these conductors for high-field magnet applications. (auth)

17834 ELECTRICAL AND THERMAL CONDUCTIVITIES OF Cu–4, 10, AND 20 AT. PERCENT Ni FROM 1 TO 25 K. Linz, R. J. (Argonne National Lab., IL); Bouley, A. C.; Klaffky, R. W.; Damon, D. H. IEEE Trans. Magn.; MAG-11: No. 2, 305-308(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Electrical and thermal conductivities of ^{4}Cu, ^{10}Cu, and ^{20}Cu at. percent Ni are presented from 1 to 25°K. These alloy concentrations are typical of those being used in some composite superconductors to minimize electrical coupling between filaments during rapidly changing fields. Data are presented for both highly annealed and heavily deformed specimens. For a given alloy, the electrical conductivities increase as a result of deformation and can vary by nearly 10 percent. The thermal conductivities decrease as a result of deformation and can vary by greater than a factor of 2 for T greater than or equal to 4°K. (auth)

17835 AC LOSSES OF Nb_3Sn. Bussiere, J. F.; Garber, M.; Suenaga, M. (Brookhaven National Lab., Upton, NY). IEEE Trans. Magn.; MAG-11: No. 2, 324-327(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

60-Hz losses were measured at 4.2°K in a number of Nb_3Sn rods and tapes produced by the bronze-diffusion process and in commercial Nb_3Sn tapes. At low fields (less than or equal to 900 Oe), losses vary by more than two orders of magnitude among the different samples and are related to surface topography. At high fields (greater than or equal to 2 kOe) the variation among samples is much less, and depends mainly on the bulk critical current density J/sub c/. The losses are analyzed quantitatively in terms of the critical state model, including a surface current. (auth)

17836 FLUX-FLOW-LIKE STATE OF A Pb-Tl ROD IN A LONGITUDINAL FIELD. Irie, F.; Ezaki, T.; Yamafuji, K. (Kyushu Univ., Fukuoka). IEEE Trans. Magn.; MAG-11: No. 2, 332-335 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Experiments and calculations have been made for the flux-flow state of the longitudinal field problem. As one of the results from these, an experimental formula was obtained, which is useful for knowing the characteristics not only of the flux-flow but also of the enhancement of the critical current. For many existing data on the critical current curve for the samples such as Pb alloy good fit with this formula is obtained. A helical stripes structure has been found experimentally, and one of the stripes domain proved to be a superconducting state. The calculations assuming the superconducting and normal stripes were qualitatively in good agreement with the experiments. Therefore, the other stripes domain is thought to be a normal state. Finally, it is expected that the problem of critical current enhancement may be solved quantitatively by the use of this helical stripes model. (auth)

17837 REDUCTION OF LOSSES AT LOW FREQUENCIES AND LARGE AMPLITUDES IN NbTi RIBBONS. Lachaine, A.; LeBlanc, M. A. R. (Univ. of Ottawa). IEEE Trans. Magn.; MAG-11: No. 2, 336-339 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The critical current density in NbTi ribbons increases considerably and hysteretic (A.C.) losses decrease by an order of magnitude when a magnetic field is present along the length of the ribbon. Rather than feeding a current to the sample through leads connected to an external supply, persistent transport currents were caused to flow along the length of the ribbon by induction (by applying a magnetic field transverse to the ribbon axis and along its broad faces). The magnitude of the induced currents, their pattern of circulation and the hysteretic losses were determined by monitoring the evolution of the magnetic moment of the ribbon both along its length and along the wide faces as the transverse field is cycled. When a longitudinal field is present, the induced currents adopt trajectories which are "tilted" and tend to lie along the total magnetic induction anti B along the flat faces of the ribbon, hence tend towards force-free configurations. (auth)

17838 ANISOTROPY OF PINNING FORCES IN NbTi. Juengst, K. P. (Kernforschungszentrum, Karlsruhe, Ger.). IEEE Trans. Magn.; MAG-11: No. 2, 340-343 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

For wire samples of cold worked Nb–40 wt percent Ti and Nb–50 wt percent Ti, a strong anisotropy of the volume pinning force F/sub p/ is observed, when the angle between transport current and external magnetic field is varied. Good agreement with the experimental results is found if F/sub p/ depends on f^2/sub p/, where f/sub p/ is the pinning force per pinning center, and if one takes into account the finite dimensions of the subbands that act as pinning centers. For the current-optimized samples, a smaller anisotropy is seen, and for recrystallized samples the pinning force is practically independent of the orientation of current and field, as it was expected. (auth)

17839 CRITICAL CURRENT DENSITY IN SUPERCONDUCTING NIOBIUM FILMS. Huebner, R. P. (Argonne National Lab., IL); Kampwirth, R. T.; Martin, R. L.; Barbee, T. W.; Zuebeck, R. B. IEEE Trans. Magn.; MAG-11: No. 2, 344-346 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The critical current was measured at 4.2°K in Nb-strips of 1 mu m thickness and different width, w, prepared by electron-beam vacuum-deposition. The substrate temperature during the deposition was varied between room temperature and 800°C. The width of the Np strips ranged between 20 and 300 mu m. Whereas up to 600°C the different substrate temperatures yielded about the same average critical current density, J/sub c/, (critical current divided by sample cross section) the specimens prepared with 800°C substrate temperature showed a reduction of J/sub c/ by a factor of 4-6. In zero applied magnetic field, the samples prepared with 400°C substrate temperature or lower showed a decrease of J /sub c/ roughly proportional to w/sup -½/. The critical current data obtained in an applied perpendicular field, for the high-field regime, were compared with Kramer's theory of flux pinning which assumes plastic shearing of the flux-line lattice around individual pinning sites during flux flow. (auth)

17840 AC CRITICAL CURRENTS OF COMMERCIAL Nb_3Sn TAPES. Garber, M.; Shen, S.; Bussiere, J.; Morgan, G. (Brookhaven National Lab., Upton, NY). IEEE Trans. Magn.; MAG-11: No. 2, 373-376 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Quench currents and critical currents have been measured for a number of commercial Nb_3Sn tapes at 4.2°K. The measurements were made at 60 Hz. The observed quench currents in the as-received tapes are considerably lower than the critical currents, which can be determined by a new technique after stabilizing material is added. The temperature dependence over the entire range above 4.2°K was measured for two of the samples. The critical current falls off approximately as $1-(T/T/\text{sub c})^2$. (auth)

17841 ANALYTICAL STUDY OF CURRENT-SHARING AT POWER FREQUENCY BETWEEN A TYPE II SUPERCONDUCTING COMPOSITE WITH A NORMAL METAL BACKING. Morgan, G. (Brookhaven National Lab., Upton, NY). IEEE Trans. Magn.; MAG-11: No. 2, 401-404 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Current sharing in a two-layer composite is studied analytically by numerically solving the 1-dimensional diffusion equation in the normal metal and the phenomenological critical state model with field independent critical current density J/sub c/ (T) in the superconductor, with boundary conditions appropriate to a transmission line at each surface and the interface. It is found that with a sufficiently low resistivity (rho) backing, and reasonable assumptions as to heat transfer, an appreciable fraction of a current density of several thousand amps per cm can be carried in the backing with the balance in a superconductor with high T/sub c/ such as NB_3Sn. The dependence of the dissipation on such parameters as thickness, J/sub c/, rho and frequency at constant temperature is given, and typical loss voltage waveforms presented. (auth)

17842 CRITICAL CURRENT DENSITIES IN Nb_3Ge BETWEEN 14 AND 21°K. Bartlett, R. J.; Laquer, H. L.; Taylor, R. D. (Los Alamos Scientific Lab., NM). IEEE Trans. Magn.; MAG-11: No. 2, 405-407 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Self field critical current densities of thick Nb_3Ge films were measured in the liquid hydrogen temperature range 13.8 to 21°K. Bulk critical current densities J/sub c/ above 1.6×10^6 A/cm² were observed at 14°K, falling linearly at higher temperatures. The behavior extrapolated to zero critical current gave a critical temperature T/sub c/ approximately 19.2°K which is approximately 1.5°K lower than the onset T/sub c/ determined from the ac magnetic susceptibility. The samples were long sections of copper tubes, which had been coated on the inside with Nb_3Ge by a chemical vapor deposition process. J/sub c/ for various high T/sub c/ materials are compared including calculations of adiabatic stability. Nb_3Ge holds promise for a dc superconducting power transmission line operating near 14°K. (auth)

17843 MULTIPOLE MAGNETIC FIELD TRAPPING BY SUPERCONDUCTORS. Rabinowitz, M. (Electric Power Research Inst., Palo Alto, CA). IEEE Trans. Magn.; MAG-11: No. 2, 548-550 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Multipole magnetic fields up to 17,600 Oe were trapped transversely to the axes of solid, hollow, and split hollow superconducting cylinders. Dipole, quadrupole, and sextupole magnetic fields were permanently stored with high fidelity to the original fields using Pb, Nb, and Nb_3Sn. The advantages of this technique are manifold: 1. Only one pattern magnet has to be made, whose field, regardless of configuration, may then be inexpensively replicated ad infinitum. 2. There is a saving of space, weight, and material. 3. There is a saving of electrical power, as the only power loss is due to heat conduction. 4. The stored magnetic field can remain extremely stable over long periods of time. 5. The magnetic field can persist for long durations even during power curtailments or shutdowns. This paper will explore the advantages and limitations of this technique, experimental results, geometry effects, and possible applications. (auth)

Radiation Effects

Refer also to abstracts 17863, 19251, 19466, 19468, 19469, and 19471.

17844 (CONF-740651-7) EVALUATION OF COMMERCIAL PRODUCTION A533-B PLATES AND WELD DEPOSITS TAILORED FOR IMPROVED RADIATION EMBRITTLEMENT RESISTANCE. Hawthorne, J. R.; Koziol, J. J.; Byrne, S. T. (Naval Research Lab., Washington, D. C. (USA); Combustion Engineering, Inc., Windsor, Conn. (USA)). 1974. 14p.

From symposium on the effects of radiation on structural materials; Gatlinburg, Tennessee, USA (11 Jun 1974).

A cooperative AEC/C-E/NRL research program is exploring trends in radiation effects for commercially produced ASTM A533-B steel plates, weld deposits, and weld heat affected zones with three controlled levels of impurity copper content. The primary objective is to establish the trend of improved 550°F (288°C) radiation performance with progressive reductions in allowable copper content. Objectives are to develop information assisting the formulation of special specifications for steels for nuclear service and the delineation of associated embrittlement trends for vessel design and operation. This report summarizes findings on the radiation resistance of two of three series of A533-B plates and weldments. Series 1 materials contained greater than or equal to 0.15 percent Cu, typical of nonimproved steel production (pre-1971). Series 2 materials contained 0.10 percent Cu max, representative of improved steel production (current practice). Radiation resistance was assessed from Charpy-V (Cv) notch ductility changes with irradiation to two fluence levels: 2-3 x 10^{19} and 4.5 x 10^{19} n/cm^2 greater than 1 MeV. Data trends indicate a marked improvement in radiation resistance with the specification of 0.10 percent max Cu. The improvement is evident both in a smaller increase in Cv 30 ft-lb transition temperature and in a smaller decrease in Cv upper shelf energy with irradiation. New ASTM and AWS specifications proposing to restrict the copper, phosphorous and sulfur contents of A533-B plates and weld deposits for nuclear service are reviewed and appear well formulated from the experimental findings presented here. The effectiveness of postirradiation 650 F (343 C)-168 hour heat treatment for notch toughness recovery was also explored. 12 fig, 6 tables. (auth)

17845 (KFK-2109) RADIATION DAMAGE AND ION BEHAVIOUR IN ION IMPLANTED VANADIUM AND NICKEL SINGLE CRYSTALS. Ion Implantation in Superconducting Thin Films. Gettings, M.; Langguth, K. G.; Linker, G.; Meyer, O.; Mann, H.; Phrilingos, E. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Angewandte Kernphysik). Oct 1973. 26p. INIS.

Available from ZAED. Repr. from applications of ion beams and metals. Book available from Plenum Publishing Corp.

Distributions and annealing behavior of heavy-ion induced radiation damage in single crystal Ni and V are compared. Sharp annealing stages are reported for Ni while for V the production of a polycrystalline layer prevented the annealing of damage after high dose implantations. The use of $^4He^+$ ion channelling revealed disorder at depths much greater than the ions' projected range. Implanted ion diffusion in vanadium was found to be dependent on the ion species used and the annealing behavior of precipitates. The influence of ion implantation on the properties of superconducting thin films consisting of Ti, Zr, V, Nb, Ta, Mo, W, Re, Nb_3Sn, NbC, or NbN are reported. Both chemically active and inert ions were used in order to distinguish between radiation damage and other effects influencing the transition temperature T_c. Successively larger decreases in T_c, due to radiation damage, were obtained for NbC, NbN, Mo, Ta, V, Nb and Nb_3Sn in that order. (DE)

17846 PECULIARITIES OF THE INTERACTION BETWEEN LASER RADIATION AND MATTER AT HIGH PRESSURES OF THE AMBIENT MEDIUM. Rykalin, N. N.; Uglov, A. A.; Nizametdinov, M. M. (Inst. of Metallurgy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 2, 722-732(Aug 1975). (In Russian).

Experimental data are presented on the interaction between radiation from a free-running neodymium laser and metals (molybdenum, stainless steel) and dielectrics (textolite, ceramics) under conditions of a high ambient pressure. It is shown that on growth of pressure of the medium in the 30 to 100 atm. range and fluxes of 10^6 to 10^7 W/cm^2 the target is almost completely shielded by the plasma cloud. The primary mechanism of formation of a laser radiation absorption zone in a high pressure cold gas near the target is thermo-emission (for weak evaporation) or breakdown in vapor of the sublimated matter (for strong evaporation). The principal mechanism of plasma cloud maintenance for fluxes of 1 to 10 MW/cm^2 is slow combustion. It is noted that the periodic variation of plasma brightness occurring after termination of action of the radiation on dielectrics may be ascribed to evolution of energy in a chemical reaction, the development of which depends on the time required for attainment of a certain temperature, which itself depends on the particle size. Target characteristics in the action zone are considered which depend on the radiation flux and gas pressure in the chamber. (auth)

17847 CHANGE IN SOLID STATE-LIQUID TRANSFORMATION TEMPERATURE IN METALS UNDER EFFECT OF POWERFUL γ-RADIATION. Danil'chenko, B. A.; Krulikovskaya, M. P.; Chirko, L. I. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 5, 767-771(May 1975). (In Russian).

The influence of ^{60}Co γ-irradiation of (1-2) 10^3 R/s was studied as applied to the temperature (T_0) of melting and formation of lithium, aluminium, and tin crystals. It is shown that T_0 decreases under irradiation. The value ΔT_{melt} for aluminium and lithium is equal to 0.3 – 0.4°C and ΔT_{form} for them is equal to 0.9 – 1°C when the power of γ-quantum flux is $1 \cdot 10^3$ R/s. It is established that in lithium the value ΔT per single interval of the absorbed energy — (ΔT_{eff}) is three times as much as that in aluminium and fifty times as much as that in tin. Thus the value ΔT_{eff} decreases with an increase in atomic weight of the metal. It is found that ΔT_{melt} for aluminium is of linear dependence on the power of γ-irradiation. The mechanism of the observed phenomena is discussed. (auth)

17848 MEASUREMENT OF THE ELECTRICAL IMPURITY PROFILE OF IMPLANTED IONS, USING THE PULSED MOS C–V TECHNIQUE. Verjans, J.; van Overstraeten, R. J. (Univ., Louvain, Belg.). Solid-State Electron.; 18: No. 11, 911-916 (Nov 1975).

The differential capacitance technique used on a MOS structure with a pulsed bias applied, is well suited for the determination of low dose impurity implantations. It is a nondestructive method and requires no extra processing steps. The limitations restricting the use of this technique are discussed. It is shown that for steep profiles a correction due to the existence of a diffusion potential has to be taken into account. The range in which this diffusion voltage is important is the same as for the correction proposed by Kennedy and O'Brien (IBM J. Res. Dev.; 13: 212 (1969)) which arises from the difference between the impurity profile and the majority carrier profile in the quasi-neutral condition. The method of calculation and the experimental verification are discussed. (auth)

17849 DEFECT CASCADES AND POINT DEFECTS IN LOW-TEMPERATURE NEUTRON IRRADIATED α-TIN MONITORED BY MOESSBAUER SPECTROSCOPY. Vogl, W.; Vogl, G. (Technische Universitaet Muenchen, Garching, Ger.). Solid State Commun.; 17: No. 8, 1029-1033(15 Oct 1975).

Neutron irradiation of cubic α-tin at 4.6°K leads to a new component in the Mössbauer spectra similar to tetragonal β-tin, disappearing again during annealing between 90 and 160°K. From the striking difference between the fractions of the new component in absorber spectra and in source spectra it is concluded that it is due (a) to defect cascades from fast neutron collisions and (b) to point defects from the (n,γ) recoil. (auth)

17850 HVEM IN-SITU OBSERVATIONS OF DISLOCATION BEHAVIOR IN STRONGLY ELECTRON-IRRADIATED NICKEL. Saka, H.; Noda, K.; Matsumoto, K.; Imura, T. (Nagoya Univ., Japan). Phys. Status Solidi (a); 31: No. 1, 139-149(Sep 1975).

Nickel foils which were damaged by the irradiation of high-energy electrons at room temperature in a high voltage electron microscope (HVEM) were deformed in-situ while under observation and the behavior of dislocations was studied. The behavior of dislocations in the damaged crystal is different from that in the undamaged one. In the damaged crystals dislocation channeling is observed. (auth)

17851 INFLUENCE OF γ IRRADIATION ON THE ELECTRICAL PROPERTIES OF n–Ge WITH NONUNIFORM DISTRIBUTION OF IMPURITY. Antonenko, R. S.; Shakhovtsov, V. I.; Shakhovtsova, S. I. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 6, 899-902(Jun 1975). (In Russian).

The anomalous temperature dependence of electron mobility was obtained within a range of 77 to 300°K for γ-irradiated samples of orientation both $I \parallel \text{grad}\,\rho$ and $I \perp \text{grad}\,\rho$. It is shown that the current–voltage characteristics are linear right up to the doses providing high compensation of the initial conductivity of the samples. Results are discussed in terms of the models of strongly inhomogeneous compensating semiconductor. (auth)

17852 ORIENTATION DEPENDENCE OF THE THRESHOLD DISPLACEMENT ENERGY IN COPPER AND VANADIUM. Kenik, E. A.; Mitchell, T. E. (Case Western Reserve Univ., Cleveland). Philos. Mag.; 32: No. 4, 815-831(Oct 1975).

The threshold displacement energy E_d, was determined by

high-voltage electron microscopy for copper and vanadium as a function of orientation: for copper, $E_d(100) = 27$ eV, $E_d(110) = 18$ eV, and $E_d(111) = 29$ eV; for vanadium, $E_d(100) = 30$ eV, $E_d(110) = 39$ eV, and $E_d(111) = 34$ eV. The minimum threshold directions are consistent with other observations of (110) in fcc and (100) in bcc. Significant subthreshold displacements were observed in copper. This is interpreted in terms of a series collision involving interstitial hydrogen as an intermediate particle. A good correlation is found to exist between the threshold energy and the sublimation energy (E_s) for a wide variety of metals, following the original suggestion of Seitz (1949). It is shown that the minimum E_d is approximately $4E_s$ and the average E_d is approximately $5E_s$. (auth)

17853 RELATIONSHIP BETWEEN EQUIVALENT CHROMIUM CONTENT AND IRRADIATION-INDUCED SWELLING IN TYPE 316 STAINLESS STEEL. Bates, J. F.; Guthrie, G. L. (Westinghouse Hanford Co., Richland, WA). Nucl. Technol.; 27: No. 2, 286-291 (Oct 1975).

The equivalent chromium content of Type 316 stainless steel is shown to be directly related to irradiation-induced swelling in specimens that have slightly different chemical compositions. In some cases, increased concentrations of an alpha-stabilizing minor constituent--silicon, phosphorus, and molybdenum--resulted in decreased swelling. The relative swelling resistance of alloys having the same carbon and equivalent nickel contents will be higher for those alloys with the higher equivalent chromium content. (auth)

17854 NEUTRON-INELASTIC-SCATTERING MEASUREMENTS OF PHONON PERTURBATIONS BY DEFECTS IN IRRADIATED COPPER. Nicklow, R.M.; Coltman, R.R.; Young, F.W. Jr.; Wood, R.F. (Solid State Division, Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Rev. Lett. 35: No. 21, 1444-1447 (24 Nov 1975).

Neutron-scattering measurements have been made at 10 *K* of phonons in a copper crystal neutron-irradiated at 4 *K*. The results, though clearly showing *q*-dependent defect-phonon perturbation effects, could not be explained entirely by simplified calculations for the ⟨100⟩ split interstitial. A 300-K anneal removed the irradiation-induced line broadening and frequency shifts but only ~50% of the additional peak structure, which was completely removed only after an 800-K anneal. (auth)

17855 NEUTRON INDUCED DISORDER IN SUPERCONDUCTING A-15 COMPOUNDS. Sweedler, A. R. (Brookhaven National Lab., Upton, NY); Cox, D.; Schweitzer, D. G.; Webb, G. W. IEEE Trans. Magn.; MAG-11: No. 2, 163-165(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The effect of high energy neutron (E greater than 1 MeV) irradiation at 60°C on the superconducting critical temperature, T/sub c/, the upper critical field, H/sub c2/, the lattice parameter, a_0, and the degree of Long Range Order has been measured for Nb and V based A-15 superconducting compounds. Large reductions in T/sub c/ and H/sub c2/ are observed for fluences up to 5.0 x 10^{19} n/cm^2. For Nb_3Al, a_0 increases and the degree of Long Range Order is significantly reduced as T/sub c/ is depressed. Results are discussed in terms of atomic ordering in the A-15 structure. (auth)

17856 NEUTRON IRRADIATION OF Nb_3Sn AND NbTi MULTIFILAMENTARY COMPOSITES. Parkin, D. M.; Sweedler, A. R. (Brookhaven National Lab., Upton, NY). IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 166-169(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

NbTi and Nb_3Sn multifilamentary composites were irradiated with fast neutrons at 60 +- 5°C to fluences of 1.2 x 10^{20} n/cm^2 (E greater than 1 MeV). The NbTi samples show only a moderate reduction of I/sub c/ as a function of neutron fluence in an applied field of 40 kG. Reductions in I/sub c/ were observed for fluences greater than 3 x 10^{17} n/cm^2 and saturate at 18 percent for fluences greater than 3-4 x 10^{19} n/cm^2. The Nb_3Sn composites showed large neutron radiation-induced changes in T/sub c/, I/sub c/, and H/sub c2/. Reductions in T/sub c/ were observed for fluences greater than 7 x 10^{17} n/cm^2. No measurable changes in I/sub c/ (40 kG) were observed below 10^{18} n/cm^2. Between 2 and 3 x 10^{18} n/cm^2, however, there is an apparent threshold where a very rapid reduction in I/sub c/(40 kG) is initiated. At the threshold the decrease in T/sub c/ is 13 percent. Between the threshold and 1.1 x 10^{19} n/cm^2, I/sub c/(40 kG) was reduced to 4 percent of the unirradiated value. These changes in superconducting properties in NbTi and Nb_3Sn are analyzed in terms of the radiation-induced defects. The impact of the response to irradiation of both materials on their applications in fusion reactor magnets is discussed. (auth)

17857 EFFECTS OF FAST NEUTRON IRRADIATION AT LOW TEMPERATURE ON THE PROPERTIES OF Nb-Ti SUPERCONDUCTOR WIRES. Couach, M.; Doulat, J.; Bonjour, E. (CEN, Grenoble, France). IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 170-173(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The object of this work was to estimate the effects of neutron irradiation at 77°K on commercial stabilized superconductor wires. Irradiation doses of 10^{18} to 10^{19} fast neutrons per cm^2 were explored and the critical current measured in magnetic fields extending from 2 to 8 Teslas. A reduction in the critical current density, depending on the type of the conductor, was observed and for the single core wire a decrease of the take-off voltage indicates a loss of stability. 9 fig. (auth)

17858 IRRADIATION AND ANNEALING EFFECTS OF DEUTERON IRRADIATED NbTi AND V_3Ga MULTIFILAMENTARY COMPOSITE WIRES AT LOW TEMPERATURE. Seibt, E. (Univ., Karlsruhe, Ger.). IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 174-177(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

To study the effects of low-temperature irradiation on technological type II-superconductors, NbTi and V_3Ga multifilamentary composite wires, the critical current I/sub c/ and transition temperature T/sub c/ were measured before and after irradiation with 50-MeV deuterons at 10 and 15°K, respectively. While the irradiation effects on I/sub c/ and T/sub c/ of NbTi are substantially unaffected, the V_3Ga wires undergo a reduction in I/sub c/ of about 50 percent and T/sub c/ decreases from 14,7 +- 0,1°K to 12,3 +- 0,1°K at a total deuteron flux of 2,6 x 10^{17} cm^{-2}. Annealing experiments at room temperature and 100°C show only a small recovery of the superconducting properties up to 15 percent. The field dependence of the volume pinning force densities P/sub V/ was determined and the results are shown to be consistent with a qualitative dynamic pinning model. (auth)

17859 INFLUENCE OF LOW TEMPERATURE NEUTRON IRRADIATION ON SUPERCONDUCTING MAGNET SYSTEMS FOR FUSION REACTORS. Soell, M. (Max-Planck-Institut fuer Plasmaphysik, Garching, Ger.); van der Klein, C.A.M.; Bauer, H.; Vogl, G. IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 178-181(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Components (insulation, stabilization material and the superconductor) of a superconducting coil system for a fusion reactor are exposed to fast neutrons, probably with a dose of about 10^{18} n/cm^2 during the lifetime of a reactor, and with an energy spectrum comparable with the one of a fission reactor. Experimental investigations were made on the influence of low-temperature neutron irradiation on the stability of a superconductor and of the superconducting properties of NbTi wires with different initial j/sub c/ and pre-treatment. The influence on j/sub c/ and T/sub c/ of Nb_3Sn was investigated. (auth)

17860 MANY-BODY EFFECTS IN X-RAY PHOTOEMISSION FROM MAGNESIUM. Ley, L.; McFeely, F. R.; Kowalczyk, S. P.; Jenkin, J. G.; Shirley, D. A. (Univ. of California, Berkeley). Phys. Rev., B; 11: No. 2, 600-612(15 Jan 1975).

X-ray photoemission experiments were performed on samples of magnesium and aluminum prepared with clean surfaces in ultrahigh vacuum. Core-level binding energies were in excellent agreement with x-ray emission data. Asymmetries in core-level peaks were observed and are compared with theory. The Mg KLL Auger spectrum showed kinetic energies higher than the literature values. Many-body effects, in the form of extra-atomic relaxation, were present in core levels and Auger lines. Both KL_1V and $KL_{2,3}V$ Auger peaks of Mg were observed. Many-body effects were also manifest as rich plasmon satellite structure accompanying every primary peak. The valence-band spectrum was compared with x-ray emission data and with the $KL_{2,3}V$ peak. The spectra were interpreted in terms of energy-level diagrams rather than one-electron levels. It is argued that valence-band spectra obtained by different methods can be compared most directly among states with the same number of core holes. A hierarchical classification of hole states is suggested. The effect of the degree of localization of the hole state on the relaxation energies in metals is discussed and shown to be small. It was observed that in several light metals the energies required to remove a valence-band electron or a unipositive ion core are about equal. (auth)

17861 RECOVERY OF LEAD AFTER ELECTRON IRRADIATION AT 1.5°K. Birtcher, R. C. Urbana, IL; Univ. of Illinois (1975). 63p. University Microfilms Order No. 75-24,262.

Thesis (Ph. D.).

The low temperature recovery of lead following an electron irradiation at 1.5^{0}K shows the same features observed for all face-centered-cubic metals except for gold. The Stage I occurs below 5.5^{0}K. The I/sub D/ recovery substage occurs at 4.15 +- 0.05^{0}K with an activation energy of 0.010 eV +- 0.001 eV. The I/sub E/ substage shifts with defect concentration in lead as it does in copper. The I/sub E/ activation energy is 0.010 eV +- 0.001 eV. Since platinum and lead anneal in Stage I in the normal fashion, the strange behavior of gold is not clearly determined by its position in the periodic table. (Diss. Abstr. Int., B)

17862 DIFFUSE X-RAY DIFFRACTION ON COPPER AFTER NEUTRON IRRADIATION AT ULTRALOW TEMPERATURES. von Guerard, B. Munich; Technische Univ. (1974). 83p. (In German). INIS.

Thesis.

With the aid of diffuse x-ray diffraction near the Bragg reflections a study was made of defects in the structure of copper after reactor neutron irradiation at ultra low temperatures. The behavior of crystal defects and their clusters were observed during annealing. The theory of diffuse x-ray scattering is dealt with in rough outlines and those equations are supplied that are needed for evaluation. The measuring method, the construction of the apparatuses, and the treatment of samples are explained, and the results discussed. (DE)

Other Materials

Refer also to abstracts 17040, 17720, 17721, 17811, and 18348.

17863 (CNLM-6139) DESIGN STUDY: LITHIUM HYDRIDE INPILE CAPSULE IRRADIATION TEST. Ackermann, W. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 9 Feb 1965. 3p. Dep. NTIS $3.50.

Declassified 19 Jan 1976.

A proposal for a design study of an in-pile capsule to be used for irradiation of LiH shielding material is presented. The LiH specimen has 19-9 DL cladding. (JRD)

17864 (ERDA-tr-84) THERMAL CONTRACTION OF GLASS FIBER REINFORCED EPOXY RESINS DOWN TO THE LOWEST TEMPERATURES. Hartwig, G.; Puck, A.; Weiss, W. Translated from Kunststoffe; 64: (1974). 9p. Dep. NTIS $4.50.

The thermal contraction of glass fiber reinforced epoxy resin was measured from ambient temperature to the temperature of liquid helium on well-balanced angular compounds with two fiber directions of +-0^0 to +-90^0 taken symmetrically to the measuring direction. The dependence on the glass fiber component was investigated. Results were compared with theoretical computations; agreement is good. (DLC)

17865 (SAND-75-8222) ABSORPTION INDUCED IN FIBER WAVEGUIDES BY LOW DOSE-RATE ELECTRON AND GAMMA-RAY RADIATION. Watkins, L. M. (Sandia Labs., Albuquerque, N. Mex. (USA)). Mar 1975. Contract AT(29-1)-789. 22p. Dep. NTIS $3.50.

Comprehensive measurements of absorption versus radiation dose and recovery versus time have been performed in some optical fibers. Results show that the values of radiation-induced absorption are independent of dose rate from 5 x 10^2 to 6 x 10^6 rads/day for total doses to 6 x 10^4 rads. The fibers studied were Corning Low Loss, Schott uv, Crofon, Polystyrene Core and Galileo K2-K irradiated with ^{60}Co gamma-rays and ^{90}Sr beta particles. (auth)

17866 TEMPERATURE DEPENDENCE OF START STRESSES OF DISLOCATIONS IN LITHIUM FLUORIDE CRYSTALS IRRADIATED WITH THE 250 MeV ELECTRONS. Garber, R. I.; Malik, A. K.; Mikhailovskii, I. M.; Stratienko, V. A. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 7, 1085-1089 (Jul 1975). (In Russian)

Effect of irradiation with 250-MeV electrons on the mobility of dislocations and start stresses was studied in LiF crystals deformed by corundum indenter within a temperature range of 20-300°C. A considerable decrease in the start stresses values with the temperature is found on the irradiated samples. Reasons for such a strong temperature dependence are analyzed. (auth)

17867 OPTICAL AND ELECTRICAL EFFECTS OF HIGH CONCENTRATIONS OF DEFECTS IN IRRADIATED CRYSTALLINE GALLIUM ARSENIDE. Coates, R.; Mitchell, E. W. J. (Reading Univ., Eng.). Adv. Phys.; 24: No. 5, 593-644(Sep 1975).

Results of a study, by a number of techniques, of the damage produced by fast neutron irradiation of gallium arsenide is reported. It is shown that high-dose neutron irradiation produces a low-resistivity material of 3 Ω cm, a material that is basically crystalline but contains a high concentration of defects; the state of the material is that of a defect alloy. It is concluded that defects in neutron-irradiated gallium arsenide are not produced uniformly but in regions having a central core and a more extended spike. The concentration of defects determined from diffuse neutron scattering gives ca. 10^3 defects per primary knock-on atom. A number of facts point to the conclusion that a large proportion of the defects are in the form of interstitial/vacancy pairs. The observation of extended exponential optical absorption edge tails fits into the general pattern of this phenomenon which occurs in a wide range of thermally or structurally disordered systems. (UK)

17868 RADIATION GROWTH KINETICS OF F, E, B, AND D CENTERS IN KCl–Ag AT ROOM TEMPERATURE. Alekseev, P. D.; Lobanov, B. D.; Parfianovich, I. A. (Irkutsk State Univ., USSR). Sov. Phys. - Solid State (Engl. Transl.); 17: No. 3, 439-441(Mar 1975).

Translated from Fiz. Tverd. Tela: 17: No. 3, 679-684(Mar 1975).

The F-, E-, B-, and D-center radiation growth kinetics were studied in room temperature x-irradiated KCl–Ag crystals. Using the accepted color center models and radiation generation mechanisms, a kinetic model is proposed which satisfactorily explains the experimental growth curves. It was shown that the second F and E components take part in B-center growth and it was thence established that the primary F-center growth component in KCl–Ag is not connected with the silver ion. The proposed F-, E-, B-, and D-center growth kinetic models can be used to analyze the kinetic dependences of these centers on radiation dose at various irradiation temperatures, intensities, and crystal impurity concentrations. (auth)

17869 CONFIGURATION CHANGES OF STRUCTURE IN IRRADIATED LiF AND $LiNbO_3$ SINGLE CRYSTALS. Kolonstova, E. V.; Kulago, E. E.; Telegina, I. V. (Moscow State Univ.). Sov. Phys. - Solid State (Engl. Transl.); 17: No. 3, 582-583(Mar 1975).

Translated from Fiz. Tverd. Tela; 17: No. 3, 915-917(Mar 1975).

Changes in the diffuse scattering pattern of neutron-irradiated LiF and $LiNbO_3$ crystals were examined. It was found that local neutron-irradiated regions of LiF and $LiNbO_3$ single crystals exhibited configuration changes in the immediate environment of the atoms, which occurred under certain irradiation conditions. The nature of the radiation effects suggested that these changes were related to a definite (for each type of lattice) and irregular distribution of point defects, which altered the general vibration spectrum of a crystal. As indicated by the results of annealing of irradiated LiF crystals, the radiation defects were vacancies. Distributions of the intensity in specified models will have to be calculated in order to check this hypothesis, determine the distribution of defects, and the resultant configuration changes in the structure. (auth)

17870 STRUCTURE AND KINETICS OF TRANSFORMATIONS OF HOLE CENTER IN AN NaF : Li CRYSTAL. Gromovoi, Yu. S.; Grachev, V. G.; Semenov, Yu. G. (Inst. of Semiconductors, Kiev). Sov. Phys. - Solid State (Engl. Transl.); 17: No. 3, 620-621(Mar 1975).

Translated from Fiz. Tverd. Tela; 17: No. 3, 960-962(Mar 1975).

Molten-zone-grown NaF crystals mixed with LiF were irradiated using ^{60}Co gamma radiation and investigated. It was found that the dissociation of the V_{KA} centers began at 165°K and holes recombined partly with the F centers. At 180°K the W and H centers began to dissociate. The liberated fluorine atoms migrated and recombined with the F centers, forming regular halogen lattice ions. The only hole paramagnetic centers which withstood temperatures above 210°K were the V_{KAA} centers formed as a result of the capture of holes by halogens, which had two Li atoms in the nearest environment. (JRD)

17871 THERMOLUMINESCENCE AND EPR OF RARE-EARTH-DOPED $SrCl_2$. Sastry, M. D.; Dalvi, A.G.I.; Page, A.G.; Joshi, B. D. (Bhabha Atomic Research Centre, Bombay). J. Phys., C (London); 8: No. 19, 3232-3240(7 Oct 1975).

Thermoluminescence (TL) glow curves of gamma-irradiated $SrCl_2$ doped with Eu, Gd, Tb, and Am in trivalent form have been obtained in the temperature ranges 77 to 300°K and 300 to 600°K. The glow peaks in the lower temperature range are accounted for by the successive bleaching of V_k-type trapped hole centers. Electron paramagnetic resonance (EPR) studies of Eu-doped samples in the temperature range 300 to 500°K have been carried out in detail and the results strongly suggest that the TL glow peak around 500°K is followed by the trapping of an electron by

Eu^{3+} and the TL glow around 420°K is due to the thermal destruction of OH^0 centers. The TL glow curves have been analyzed to obtain the trap depth and frequency factors. (auth)

17872 OPTICAL DETECTION OF EXCITED EPR IN $KMgF_3$. Hayes, W.; Owen, I. B.; Pilipenko, G. I. (Oxford Univ.). J. Phys., C (London); 8: No. 19, L407-L409(7 Oct 1975).

Under irradiation with x-rays at low temperatures K MgF_3 emits a broad band peaking at 340 nm. This luminescence shows magnetic circular polarization with a resonance in low magnetic field. The magnetic properties of the emitted light are used to detect EPR in an excited $^3\Sigma$ state contributing to the emission. (auth)

17873 THERMOLUMINESCENCE OF X-RAY IRRADIATED LiD. Afordakos, G.; Varotsos, P. (Univ. of Athens). Phys. Status Solidi (a); 31: No. 1, K57-K60(Sep 1975).

Thin slices of LiD crystals containing traces of Mg were x-irradiated at liquid nitrogen temperature to room temperature. Clusters consisting of aggregated dipoles of Mg^{+2}-cation vacancy pairs with an association energy estimated at 0.1 to 0.2 eV and aggregated dipoles of O^{2-}anion vacancy pairs were found. These play an important role in the creation of traps in the energy gap of the crystal. (JRD)

17874 SEMICONDUCTING DIAMOND. Vavilov, V. S. (Lebedev Inst. of Physics, Moscow). Phys. Status Solidi (a); 31: No. 1, 11-26(Sep 1975).

Properties of semiconducting diamonds are reviewed. Information and data are included on non-equilibrium electronic processes excited in insulating diamonds, synthetic semiconducting diamonds, semiconducting diamond produced by ion implantation, and synthesis of SiC on diamonds. (JRD)

17875 EFFECT OF OXYGEN ADSORPTION ON THE γ-CONDUCTIVITY OF CADMIUM SULFIDE. Kalamazov, R. U.; Kokkozov, R. (Inst. of Nuclear Physics, Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 1, 80-83(1975). (In Russian)

A study was made of the kinetics of oxygen adsorption and of the change in electrical resistance of layers of CdS during thermal and radiation treatments in vacuum, and also during oxygen adsorption in a γ-radiation field and outside it. Oxygen adsorption on CdS takes place in charged form (in the form of a molecular ion), and hence should lead to an increase in sample resistance. At temperatures >170°C, oxygen is desorbed, and the resistance of the sample falls. Hysteresis of current is observed in samples heated in an oxygen atmosphere. The radiation chemisorption of oxygen causes a sharp decrease in resistance of the CdS layer. Oxygen is chemisorbed in charged form in a γ field. At first the rate of formation of excess electrons is greater than the capture rate of electrons by radiation-chemisorbed oxygen. Then equilibrium between these rates ensues, and this behavior leads to a steady-state value of the electrical conductivity. With an increase in oxygen pressure the steady-state resistance increases. A sharp increase in resistance is characteristic in an oxygen atmosphere on ceasing irradiation, while for a sample in vacuum the resistance increases monotonically. (SJR)

17876 X—RAY PHOTOEMISSION SPECTROSCOPY STUDY OF HEXAVALENT URANIUM COMPOUNDS. Veal, B.W.; Lam, D.J.; Carnall, W.T.; Hoekstra, H.R. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. B 12: No. 12, 5651-5663 (15 Dec 1975).

The electronic structure of the outer occupied levels of a series of hexavalent uranium (predominately uranyl) compounds was studied using x-ray photoemission spectroscopy (XPS). The changes in the spectral features of the outer occupied levels with the variation of the uranium-oxygen bond lengths (1.7–2.1 Å) are systematically investigated. Previously unexplained spectral structure has been found to result from ligand-field splitting of the occupied U6$p_{3/2}$ levels. The XPS results are compared with predictions of a relativistic molecular-cluster calculation and with the results of a simple point-charge crystal-field model. When the crystalline electric fields generated by both the primary and secondary ligands are taken into consideration, excellent quantitative agreement is obtained between the XPS data and the molecular-cluster results with no parameter adjustment. (auth)

17877 LANDAU-LEVEL SPECTRA OF CONDUCTION ELECTRONS AT AN InAs SURFACE. Tsui, D.C. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. B 12: No. 12, 5739-5748 (15 Dec 1975).

I report magneto-oscillatory effects in tunneling through in As-oxide-Pb junctions, which reflect the Landau levels of conduction electrons near the InAs-oxide interface. These oscillatory effects, which have been observed in transverse as well as longitudinal magnetic fields, are understood in terms of a qualitative theoretical picture. From the longitudinal magneto-oscillations, we have obtained that the effective cyclotron mass $m_0^*/m = 0.0215 \pm 0.0005$ at the conduction-band edge and that, at energies within 400 meV above the band edge, it increases linearly with increasing energy at a rate of 1.2×10^{-4}/meV. This value of m_0^* is ~7% smaller than that obtained from cyclotron resonance and magneto-phonon experiments on bulk InAs. The transverse magneto-oscillations are identified with Landau levels of electrons whose cyclotron orbits graze the oxide potential barrier. The level broadening Γ, as deduced from the magnetic field dependence of the oscillation amplitude, corresponds to a relaxation time ~ 10^{-14} sec. Within our experimental uncertainties, Γ increases linearly with increasing excitation energy. (auth)

17878 PRESSURE DEPENDENCE OF SUPERCONDUCTIVITY AND NORMAL CONDUCTIVITY IN POLYMERIC SULFUR NITRIDE, $(SN)_x$. Gill, W.D.; Greene, R.L.; Street, G.B. (IBM Research Laboratory, San Jose, California 95193); Little, W.A. Phys. Rev. Lett. 35: No. 25, 1732-1735 (22 Dec 1975).

The hydrostatic pressure dependence of the superconducting transition temperature T_c, the critical magnetic field H_{c2}, and the normal-state conductivity of crystalline $(SN)_x$ are reported. Under pressure T_c increases from 0.33°K(P=0) to 0.54°K(P=9±1 kbar). The increase in T_c is attributed to pressure-induced band structure changes. (auth)

17879 MAGNETO-OPTICAL AND MAGNETIZATION STUDIES IN THE RARE-EARTH ORTHOCHROMITES. IV. $ErCrO_3$. Hasson, A.; Hornreich, R.M.; Komet, Y. (Department of Electronics, The Weizmann Institute of Science, Rehovot, Israel); Wanklyn, B.M.; Yaeger, I. Phys. Rev. B 12: No. 11, 5051-5067 (1 Dec 1975).

Using combined Er^{3+} absorption spectroscopy and bulk magnetization measurements, the magnetic properties of $ErCrO_3$ in the Γ_1, Γ_2, and Γ_4 phases have been studied as a function of temperature and external field. The experimental data are analyzed using a single-ion effective field model. For the Γ_4 and Γ_1 phases the most general Cr-Er and Er-Er coupling terms allowed by symmetry are considered and the canting angle of the ordered Cr^{3+} spins (in the Γ_4 phase) is not constrained *a priori* to be temperature independent. It is concluded that the Cr-Er coupling is antisymmetric in nature and due mainly to Dzyaloshinsky-Moriya type exchange. For this type of interaction, the Cr^{3+} canting angle is indeed temperature independent and this conclusion justifies the constant-canting-angle assumption used extensively in the literature. The Er-Er coupling is found to be of dipolar origin and it is shown that this interaction results in a significant temperature dependence of the effective splitting factor as deduced from optical-absorption measurements. For the Γ_2 phase, the data for temperatures above 20°K are interpreted in terms of a constant-canting-angle model for the Cr-Er interaction. At lower temperatures it is argued that the dipolar Er-Er coupling must also be considered. (auth)

17880 STUDY OF HYPERFINE INTERACTIONS BY MOESSBAUER SPECTROSCOPY IN MIXED CRYSTALS. Malliaris, A.; Petridis, D. (Democritus Nuclear Research Center, Athens (Greece)). Chem. Phys. Lett.; 36: No. 1, 117-119(15 Oct 1975).

A mixed crystal technique, appropriate for the Moessbauer study of hyperfine interactions in molecules with D > 0, is described. It is based on the magnetic behavior of a $\pm|\frac{1}{2}>$ Kramers doublet. The method has been applied with success to the study of hyperfine structure of $Fe(methdtc)_2Br$. (NL)

17881 POINT DEFECTS IN CaF_2 FOLLOWING THE $^{19}F(n,\gamma)^{20}F$ PROCESS. Ackermann, H.; Dubbers, D.; Grupp, H.; Grupp, M., Heitjans, P.; Stoeckmann, H. J. (Institut Max von Laue—Paul Langevin, 38—Grenoble (France)). Phys. Lett., A; 54: No. 5, 399-400(6 Oct 1975).

Structure and annealing of (n,γ)-induced point defects are studied in CaF_2 by means of nuclear magnetic resonance of the neutron-activated β-emitter ^{20}F. (NL)

17882 RECOMBINATION LUMINESCENCE OF GENETIC V_k-Tl^0-PAIR CENTERS IN KCl-Tl. Aluker, E.D.; Mezina, I.P. Opt. Spectrosc. (USSR) 39: No. 2, 178-179 (Aug 1975).

A method is presented for determining the concentration of V_k centers that form genetic pairs with Tl^0 centers as a result of x-ray irradiation at liquid nitrogen temperature. It is shown that in a KCl-Tl (0.15 mol%) crystal about 10% of the V_k centers are associated with Tl^0 centers in genetic pairs. (auth)

17883 EFFECT OF HYDROSTATIC PRESSURE ON THE OPTICAL SPECTRA OF KCl-Ag CRYSTALS IRRADIATED WITH X-RAYS. Mugra, A.K.; Niilisk, A.I.; Osminin, V.S. Opt. Spectrosc. (USSR) 39: No. 2, 226-227 (Aug 1975).

The effects of pressure on the emission spectra of the Ag^- center in x-irradiated KCl crystals were investigated. It was found that the resulting spectral shift of the emission band was comparable to the shifts of other centers Tl^+, In^+ and Ga^+ in alkali halide crystals.(AIP)

17884 BORON-IMPLANTED PROFILES IN DIAMOND. Blanchard, B. (SCAG/EAPC CENG, BP 85, 38041 Grenoble, France); Combasson, J.L.; Bourgoin, J.C. Appl. Phys. Lett. 28: No. 1, 7-8 (1 Jan 1976).

Boron ions with energy ranging from 40 to 250 kev have been implanted at room temperature in type-II*a* diamonds with doses of 10^{15} and 10^{16} cm^{-2}. The boron profiles have been measured using an ion analyzer. These profiles are compared with profiles calculated using Winterbon's theory. Reasonable agreement between experimental and theoretical profiles is obtained for the electronic stopping cross section measured by Omrod *et al.* up to about 180 keV. (auth)

17885 DISTRIBUTION ACROSS THE CHANNEL OF DEFECTS INDUCED BY NITROGEN BOMBARDMENT IN SILICON. Baeri, P.; Campisano, S.U.; Ciavola, G.; Foti, G.; Rimini, E. (Istituto de Struttura della Materia, Università di Catania, Corso Italia, 57-I 95129 Catania, Italy). Appl. Phys. Lett. 28: No. 1, 9-11 (1 Jan 1976).

Silicon crystals have been implanted at room temperature with 3.2×10^{15} ions/cm^2 of 300-keV N^+. The spatial distribution of displaced atoms has been determined by the backscattering energy spectra as a function of the crystal tilting angle with respect to the ⟨111⟩ axis. The changes in the extracted depth profiles have been correlated to the nonuniform distribution of defects across the channel. The radial distribution of displaced atoms has been determined on the basis of the flux-peaking treatment for impurity lattice location. (auth)

17886 BUCKLING OF UNIDIRECTIONAL BORON/ALUMINUM STIFFENERS, A CAUTION TO DESIGNERS. Spier, E. E.; Wang, G. (General Dynamics Convair Div., San Diego, CA). J. Compos. Mater.; 9: 347-360(Oct 1975).

Unidirectional boron/aluminum stiffeners were used to save weight in stiffened panels, where the cross sections were of such shapes as hats, I's, Z's, channels, etc. The buckling analysis of these structures is usually found to be unconservative when tests are performed. Even so, a weight saving of approximately 50 percent can be achieved in the stiffeners themselves by replacing their metal counterparts. A no-edge-free crippling test was performed on a unidirectional boron/aluminum laminated plate, where collapse occurred at a compressive load considerably below the theoretical bifurcation buckling point. This premature failure is explained by a numerical analysis of the test by the use of a nonlinear computer code, which revealed the presence of high transverse bending stresses beyond the capacity of the composite. (auth)

17887 STUDY OF TRIOCTAHEDRAL MICA BY NEUTRON AND X-RAY BEAMS. Joswig, W. Frankfurt; Frankfurt Univ. (1972). 69p. (In German). INIS.

Thesis.

The trioctahedral mica phlogopit and lepidolith were investigated with neutron and x-radiation. The structure of the phlogopit is distinguished by a large regularity of the distances and angles within the individual layers. The O-H distance of the overage nuclear position is 1,003(8)A. The thermal vibrations of the protons represents approximately a flattened rotation ellipsoid in c*-direction. The lepidolith exhibits a partly ordered cation distribution in the octahedral layer. The 2d position is nearly exclusively occupied with lithium whereas the 4h position is occupied statistically with Al-Li, Li-Al and Al-Al in the same proportion. As the cations of the octahedral layer are of different valency and size, a tetrahedron tilt occurs which effects a rippling of the base oxygen layer ($\Delta Z = 0.08$ A). A Li-Al order in the tetrahedron could not be detected in either phlogopit or lepidolith. Due to the small OH content and to the only partly ordered octahedron positions of the lepidolith, the proton could not be exactly localized. (DE)

17888 COMPOSITE CONDUCTORS CONTAINING MANY FILAMENTS OF Nb_3Sn. Gregory, E.; Marancik, W. G.; Ormand, F. T. (Airco, Inc., Murray Hill, NJ). IEEE Trans. Magn.; MAG-11: No. 2, 295-298(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A 342-filament Nb_3Sn conductor made by "the bronze" approach is described in some detail. Larger conductors containing 1045 and 3553 filaments, respectively, are also mentioned. One of these contains a barrier layer to separate the bronze matrix from high conductivity copper which is required for stability in some applications. A high aspect ratio version of the 3553 filament conductor has also been made. A 67 507 filament conductor carrying 1000 A at 12 T, developed for LLL, is shown. It has been made into several different configurations, one with the size and aspect ratio of the 3553 filament conductor shows less anisotropy in current properties with different field orientations. (auth)

17889 HIGH FIELD PROPERTIES OF TERNARY METAL-MOLYBDENUM-SULFIDES. Foner, S.; McNiff, E. J. Jr.; Alexander, E. J. (Massachusetts Inst. of Tech., Cambridge). IEEE (Inst. Electr. Electron. Eng.).Trans. Magn.; MAG-11: No. 2, 155-158(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Measurements of the upper critical fields are presented for ternary metal-molybdenum-sulfides as a function of temperature, T, with dc magnetic fields up to approximately 215 kG and pulsed fields to approximately 500 kG. A nearly linear variation of H/sub C2/ versus T is observed up to the highest dc fields for all the compounds. The materials (nominal composition), T/sub c/(measured), (dH/sub C2//dT)/sub T equals T/sub c// (measured), and H/sub C2/(4.2 K) (calculated) for a dirty type II superconductor assuming no paramagnetic limiting are respectively: (a) $Pb_{0.9}Mo_{5.1}S_6$: 11.7 K, 60 kG/K, 390 kG; (b) $SnAl_{0.5}Mo_{4.5}S_8$: 14.2 K, 32 kG/K; 275 kG; (c) $SnMo_5S_8$: 13.4 K, 37 kG/K; 290 kG; (d) $PbMo_{5.1}S_6$: 14.4, 60 kG/K, 515 kG. Pulsed field measurements yield H/sub C2/(4.2 K) equals 390 kG for (a), 275 kG for (b), 290 kG for (c), and approximately equal to 510 kG for (d). The $PbMo_{5.1}S_6$ has the highest value of H/sub C2/ measured to date. (5 fig) (auth)

17890 DEFECTS IN IRRADIATED SILICON: EPR OF THE TIN-VACANCY PAIR. Watkins, G. D. (General Electric Corp, Schenectady, NY). Phys. Rev., B; 12: No. 10, 4383-4390 (15 Nov 1975).

An EPR spectrum, labeled Si-G29, is identified as a lattice vacancy trapped by substitutional tin. The resulting tin-vacancy pair is observed in its neutral ground state with S equals 1. Results of studies on wavelength of illumination indicate that it has a donor level at approximately E/sub v/ + 0.35 eV. Analysis of the EPR spectrum leads to a model in which the tin atom resides in a position halfway between two normal silicon atom sites (D/sub 3d/). It is stable to approximately 500^{0}K. (auth)

17891 EXCITON DYNAMICS IN alpha-PARTICLE TRACKS IN ORGANIC CRYSTALS: MAGNETIC FIELD STUDY OF THE SCINTILLATION IN TETRACENE CRYSTALS. Geacintov, N. E.; Binder, M.; Swenberg, C. E.; Pope, M. (New York Univ., NY). Phys. Rev., B; 12: No. 10, 4113-4134(15 Nov 1975).

The mechanisms of scintillation of organic crystals bombarded by alpha particles are discussed in terms of the current knowledge of exciton dynamics, which has been derived from a study of the photofluorescence of crystals such as anthracene and tetracene. The scintillation of tetracene excited by 4.4-MeV alpha particles incident in a direction perpendicular to the ab plane has been studied in the presence of external magnetic fields (0 to 4000 G) and compared with the scintillation of crystalline anthracene. At 298^{0}K, the magnetic field effect on the total scintillation yield is (+2.5 ± 0.5) percent in tetracene and displays a typical fissionlike (fission of one singlet exciton into two triplets) dependence. At low temperatures when fission is suppressed, a fusionlike dependence (reverse of fission) appears with a (–4 to –5) percent effect at 4000 G at 148^{0}K. In anthracene, the fusionlike dependence is observed at all temperatures in the range studied (148 to 298^{0}K). Using appropriate kinetic equations, expressions are derived for the prompt (L/sub P/) and delayed (L/sub D/) components of the total scintillation yield L equals L/sub P/ + L/sub D/. These expressions describe the temperature and magnetic field dependence of L, which arises because of the temperature and magnetic field dependence of the exciton fission and fusion rate constants in tetracene. In tetracene, L/sub D/ appears to be strongly temperature dependent, while L/sub P/ is not. This is explained in terms of the high density of transient singlet exciton quenchers in the alpha-particle track. The density of these transient quenchers is estimated to be in the range of 3×10^{17}–5×10^{18} cm^{-3}, and they are identified, in accord with a previous suggestion by Schott, as triplet excitons which are created by random recombination of electrons and holes in the alpha-particle track. (auth)

17892 ION TREATMENT OF SILICON IN A GLOW DISCHARGE. Sokolowski, M.; Sokolowska, A.; Rolinski, E.; Michalski, A. (Warsaw Technical Univ.). Thin Solid Films; 30: No. 1, 29-35(Nov 1975).

The N, Ni, Al, C ion treatment of a silicon single crystal under the conditions of a dc glow discharge was studied. It was found that in such circumstances doping and surface thin film formation may occur. The explanation put forward is based on the assumption of a very low energy ion implantation. (auth)

NUCLEAR MATERIALS AND WASTE MANAGEMENT

Refer also to abstract 17179.

17893 (ERDA-1538(Vol.1)) FINAL ENVIRONMENTAL STATEMENT, WASTE MANAGEMENT OPERATIONS, HANFORD RESERVATION, RICHLAND, WASHINGTON. Volume 1. (Energy Research and Development Administration, Washington, D. C. (USA)). Dec 1975. 593p. Dep. NTIS $13.60 (Vols. 1 and 2).

The impacts and alternatives available to the ongoing Hanford Waste Management Operations Program are presented. Environmental effects of routine operation of plant facilities are considered. Reasonable alternatives to the current program for treatment of high-level liquid radioactive waste, other radioactive liquid waste, radioactive gaseous wastes, radioactive solid waste, nonradioactive waste, and other potential environmental pollutants are given. (LK)

17894 (ERDA-1538(Vol.2)) FINAL ENVIRONMENTAL STATEMENT, WASTE MANAGEMENT OPERATIONS, HANFORD RESERVATION, RICHLAND, WASHINGTON. Volume 2. (Energy Research and Development Administration, Washington, D. C. (USA)). Dec 1975. 428p. Dep. NTIS $13.60 (Vols. 1 and 2).

Volume 2 contains appendices, including maps and tabulations of inventories; demographic and archaeological data; and models and computer codes for evaluating environmental radiation doses. (LK)

17895 (SAAS-181, pp 46-60) RESULTS OF THE ACTIVITIES OF THE "COORDINATION COUNCIL ON RADIOACTIVE WASTE DISPOSAL AND DECONTAMINATION" OF THE PERMANENT COMMISSION OF ATOMIC ENERGY OF CMEA. Richter, D. Jul 1975. (In German)

In report of the National Council for Atomic Safety and Radiation Protection of the German Democratic Republic.

Previous reports and recommendations on the treatment and disposal of liquid, solid, and gaseous radioactive wastes are summarized. These include processing of liquid wastes of low to medium activity, disposal of radioactive wastes in ground layers near the surface, disposal of radioactive wastes in deep geological formations, and surface decontamination. The work on gaseous wastes included information exchange on the status of research in this area and calculations on their propagation in the atmosphere. A program was set up for monitoring the propagation of radioactivity in surface waters. (JSR)

Accountability and Safeguards

17896 IN-LINE STATION FOR VOLUME CALIBRATION OF RASCHIG-RING-FILLED STORAGE TANKS FOR FISSILE SOLUTION. Rothe, R. E.; Doher, L. W.; Johnston, A. L. (Rockwell International, Golden, CO). Nucl. Technol.; 28: No. 1, 165-171 (Jan 1976).

A station was installed at the Rocky Flats Nuclear Safety Laboratory to volume-calibrate their storage tank farm housing 560 kg of enriched (93.2 percent ^{235}U) uranium solution. The calibration (relating contained solution volume to height) of tanks used to store or process fissile materials is often complicated by the large surface area presented by thousands of borosilicate glass rings used for criticality prevention. Yet, an accurate and reliable measurement of this relation is important to good material accountability and possibly to nuclear safety. The latter purpose can be served by detecting accumulations of insoluble precipitates or the formation of critically unsafe voids in the bed of rings. With this station, calibrations are easily accomplished with an accuracy better than 1 liter at any point within a 500-liter tank. Additional benefits include increased safety through reduced potential for contamination release, improved efficiency since one operator replaces the previously required two, and the complete elimination of both solid and liquid contaminated waste generation. (auth)

17897 VOLUME CALIBRATION TECHNIQUE FOR NUCLEAR MATERIALS CONTROL. N15.19-1975. New York; American National Standards Institute, Inc. (1975). 28p. (ICONS-02078).

This standard is applicable to the calibration of straight-wall tanks equipped with response systems for measuring either liquid level or pressure. The standard describes equipment, procedures, precautions, and statistical techniques necessary for the generation of a calibration equation used for quantitative determination of volumes for in-tank determinations of solutions containing nuclear materials. (WHK)

17898 ADMINISTRATIVE GUIDE FOR VERIFYING COMPLIANCE WITH PACKAGING REQUIREMENTS FOR SHIPMENTS OF RADIOACTIVE MATERIALS. ANSI-N14.10.3-1975. New York; American National Standards Institute, Inc. (1975). 19p. (ICONS-02076).

This standard presents: a method whereby compliance with packaging requirements may be obtained and documented; guidance to be followed in the event of incidents that threaten package integrity; and a plan for receivers to verify the integrity of delivered packages. Techniques that have been successfully used and proved in practice are described as illustrations of acceptable methodology. (DLC)

17899 CONCEPTS AND PRINCIPLES FOR THE STATISTICAL EVALUATION OF SHIPPER-RECEIVER DIFFERENCES IN THE TRANSFER OF SPECIAL NUCLEAR MATERIALS. ANSI-N15.17-1975. New York; American National Standards Institute, Inc. (1975). 4p. (ICONS-02080).

17900 OBSERVATION OF THE CROSS-FIELD INSTABILITY IN LABORATORY PLASMA. Saxena, Y.C.; John, P.I. (Physical Research Laboratory, Ahmedabad 380 009; India.). Geophys. Res. Lett. 2: No. 11, 492-495 (Nov 1975).

In an experiment simulating certain characteristics of the equatorial electrojet plasma (viz. $\nu_e \ll \Omega_e, \nu_i \gtrsim \Omega_i, \vec{E}, \Delta n \vec{B}$), low frequency ($\omega \approx \Omega_i$) waves travelling in $\vec{E} \times \vec{B}$ direction are observed. These waves are identified to the modes generated by the cross-field instability. The spectrum of the potential fluctuations has an index $\beta \simeq -5.8$. The observed spectrum also indicates generation of a mode by wave-wave interaction of two modes, as well as a m=0 mode stationary in the $\vec{E} \times \vec{B}$ direction. (auth)

Disposal and Storage

Refer also to abstracts 16700, 16714, 17182, and 17896.

17901 RADIOACTIVE WASTE MANAGEMENT: THE NUCLEAR WASTE FORM. McCarthy, G. J. (Pennsylvania State Univ., University Park). Earth Miner. Sci.; 45: No. 3, 17-21 (Dec 1975).

The selection and design of the optimum solid waste form to contain the dangerous nuclides during transport, storage, and disposal of nuclear wastes are discussed. Particular emphasis is placed on studies on crystalline ceramic waste forms, which upon heating to 1,100°C showed no significant volatilization of waste species. All of the dangerous and troublesome constituents are apparently fixed in mutually crystalline phases. (JGB)

17902 PRESENT METHODS OF STORING HIGHLY RADIOACTIVE WASTE IN THE UNITED KINGDOM AND PROPOSALS FOR THE FUTURE. Clelland, D. W. pp Paper 4.2-7, 20p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910--P4.

Of the many types of radioactive waste resulting from nuclear operations the most active and hazardous is the highly active liquid waste from the reprocessing of irradiated fuels. The management of waste of this type from the United Kingdom nuclear power programme is covered. At present it is the general practice in all countries to store high level liquid waste in high integrity tanks. At Windscale the highly active waste from reprocessing operations is concentrated by evaporation to a small bulk and stored in the acidic state in high integrity stainless steel tanks fitted with cooling coils for the removal of fission product decay heat. The present tank storage system for highly active liquid waste has now been in operation in the United Kingdom for nearly 20 years and during that time no serious problems have been encountered. This system is considered satisfactory and safe for the present, and for some considerable time ahead, assuming surveillance is maintained; spare tanks are available in case of unexpected failures and an adequate policy of tank replacement is instituted. Although the liquid storage system is satisfactory both in terms of its integrity and cost for the present and can be continued for some time, it is recognized that in the longer term it will be necessary to solidify the waste, thereby immobilizing it and further ensuring its containment, making surveillance less vital and reducing the requirements for replacement of storage facilities. Studies of solidification processes have indicated that a suitable system could be introduced to deal with the United Kingdom program. Engineering design studies and development of a solidification process (HARVEST) are now under way and it is planned to demonstrate fully active solidification of waste on a production scale in the mid 1980's. (auth)

Handling Equipment and Procedures

17903 CRITICALITY SAFETY DATA APPLICABLE TO PROCESSING LIQUID-METAL FAST BREEDER REACTOR FUEL. Lloyd, R. C.; Clayton, E. D. (Battelle-Pacific Northwest Labs., Richland, WA). Nucl. Sci. Eng.; 59: No. 1, 21-26(Jan 1976).

Critical-experiment data are presented on a heterogeneous lattice of fuel rods comprised of uranium and plutonium oxides, clad with stainless steel, and moderated with (U + Pu) nitrate solution, a condition not unlike that encountered in a fuel-element dissolver operation. The effect of a soluble neutron absorber (gadolinium nitrate) on the criticality of this type of system was also examined for its possible use as a method of criticality prevention and control during the dissolution step. The results provide data for code validation, an essential requirement on complex systems such as this, if the calculations are to be utilized to prescribe subsequent control limits under similar or related conditions in fuel processing. Experiments indicate (for the very limited data presented) that a heterogeneous system composed of these fuel rods in water can have a larger buckling than the fuel in the dissolved state. The question is, whether a fuel rod of a size different from that used in these experiments, immersed in fissile-bearing solutions, might have a still higher buckling (and smaller critical size) than the highest achievable buckling for fuel rods of optimum diameter and spacing in water. This important consideration regarding the criticality safety aspects of dissolvers must be examined in each case. The results of calculations of these systems with the KENO Monte Carlo code utilizing ENDF/B-III cross sections are presented. (auth)

Transportation

Refer also to abstract 17896.

17904 SPENT FUEL TRANSPORTATION ON HIGHWAYS: THE RADIOACTIVE DOSE TO THE TRAFFIC. Yadigaroglu, G. (Univ. of California, Berkeley). Nucl. Technol.; 27: No. 2, 258-266(Oct 1975).

The radioactive exposure of the traffic moving on the same highway as spent fuel shipments has been neglected in the past. Methods developed for calculating peak exposures, the number of individuals receiving a dose in excess of a certain limiting value, and the cumulative population doses for the occupants of the vehicles under a variety of highway and accident conditions allow comparisons to the corresponding stationary-population doses. Consideration of both routine direct-radiation exposures and accidental releases indicates that the traffic doses can be of equal or greater importance than the stationary-population doses. (auth)

PARTICLE ACCELERATORS

Design, Development, and Operation

Refer also to abstract 19279.

17905 (GSF-P-82) ANNUAL REPORT 1974. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Arbeitsgruppe Beschleuniger). May 1975. 88p. (In German). INIS.

The Project Group Accelerator of the physical-technical department of GSF operates three large accelerators (maximum acceleration voltages of 3,000, 400, and 300 kV) and some smaller units with acceleration voltages of less than 100 kV. The various activities of the group are in two major parts: (1) all activities connected with the operation of accelerators in the broadest sense; and (2) the research projects carried out by the group, summarized under the heading "Radiation Effects on Solids". (DE)

17906 ESCAR: FIRST SUPERCONDUCTING SYNCHROTRON, STORAGE RING. Elioff, T.; Gilbert, W. S.; Lamberston, G. R.; Meuser, R. B. (Univ. of California, Berkeley). IEEE Trans. Magn.; MAG-11: No. 2, 447-450(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The ESCAR (Experimental Superconducting Accelerator Ring) project is an accelerator technology development for which the primary goal is to obtain design and operational experience with a complete accelerator and storage ring system utilizing superconducting magnets. Full scale design effort began in July 1974, and operation is planned in 1977. ESCAR will not only provide the experience of fabricating and operating an extensive cryogenic magnet system with a significant advancement beyond present experience, but it will also provide a comprehensive accelerator system from which can be learned the realities of the interaction between the new cryogenic elements and the many other components of an accelerator. The extent to which these components (e.g., rf, injection, vacuum, control systems, etc.) are compatible with the cryogenic features of the accelerator, and to which they force modifications of the design, will be determined. (auth)

Auxiliaries and Components

Refer also to abstract 17050.

17907 MULTIELEMENT ACCELERATORS ON RADIAL LINES. Pavlovskii, A. I.; Bosamykin, V. S.; Kuleshov, G. D.; Gerasimov, A. I.; Tananakin, V. A.; Klement'ev, A. P. (Leningrad State Univ.). Dokl. Akad. Nauk SSSR; 222: No. 4, 817-820(1 Jun 1975). (In Russian)

Studies were carried out on high-current, pulsed electron radial-line accelerators, and a cylindrical distribution of electromagnetic energy was obtained. The new type of linear induction accelerator formed a tubular beam, 0.15 m in diameter, and a layer of electrons $\sim 10^{-2}$ m thick. Beam currents were 100 to 150 kA at a limiting electron energy of ~1 MeV. These parameters are not limiting for this type of accelerator, and possible improvements are indicated. (SJR)

17908 50 MHz BEAM PULSER. Pixley, R. E.; Hoop, F. (Zurich Univ. (Switzerland)). Nucl. Instrum. Methods; 128: No. 2, 221-225(1 Oct 1975).

A 50 MHz beam pulser was constructed for use with a Van de Graaff accelerator. An accurate analysis of the system based on measured properties of the undeflected beam shows that the rms (root-mean-square) pulse width is 14.5 ps. Measured time spectra, which include the effects of both pulser and detector resolution, have an rms width of 36 ps. (NL)

17909 NEW TYPE OF SPIN-FLIP CHOPPER FOR POLARIZED NEUTRON BEAMS. Badurek, G.; Westphal, G. P. (Atominstitut der Oesterreichischen Hochschulen, Vienna). Nucl. Instrum. Methods; 128: No. 2, 315-321(1 Oct 1975).

A spin-flip chopper for polarized neutron beams was developed, needing less electronic equipment and offering better time resolution than radio frequency chopper systems. Flipping is achieved by static magnetic fields only, which are set up by two coils of extremely low inductivity and can be pulsed within 2 to 3 μs by simple and reliable transistor switches working in constant current mode. The effective switching length of the spin reversal device, being responsible for the flight path uncertainty, is reduced to the thickness of a single coil, which is only 0.65 cm, by delayed switching of the second coil according to the neutron transmission time through the first one. Neutron bursts of 5 μs duration and a repetition rate of 100 kHz could be obtained with this chopper. (NL)

17910 SUPERCONDUCTIVITY APPLICATIONS IN HIGH ENERGY PHYSICS. Fields, T. H. (Argonne National Lab., IL). IEEE (Inst. Electr. Electron. Eng.) Trans. Magn.; MAG-11: No. 2, 113-118(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

During the past five years, several very large superconducting bubble chamber and spark chamber magnets became operational. The economic and other factors which have led to the construction of large superconducting solenoid magnets for high energy physics research are discussed, and the technological development which made these magnets possible is summarized. Much of the recent development work on superconducting magnets for high energy physics was directed toward the next generation of accelerators and beam storage rings. Here, the goal is to develop dipole and quadrupole magnets of high field precision, low cost, high reliability, capability for slow pulsing, and minimal sensitivity to radiation heating. The status of this work and its application to future accelerators is described. Also, the application of superconducting rf cavities for linear accelerators and particle separation is reviewed briefly. (auth)

17911 HIGH-PERFORMANCE Nb HELICAL CAVITY. Benaroya, R.; Clifft, B. E.; Johnson, K. W.; Markovich, P.; Wesolowski, W. A. (Argonne National Lab., IL). IEEE Trans. Magn.; MAG-11: No. 2, 413-416(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A 92-MHz superconducting-Nb helix resonator of exceptional quality was thoroughly tested under a variety of conditions. The unit is a full-scale lambda/2 structure with dimensions appropriate for heavy-ion acceleration. When operated at a temperature of 1.8^{0}K and with bare (not anodized) Nb surfaces, the low-field Q is 9.4×10^{9}, equivalent to a surface resistance of 5×10^{-10} ohms. The maximum surface magnetic field is 1200 G and the maximum surface electric field is 37 MV/m, which corresponds to a traveling-wave axial accelerating field of 4.6 MV/m. These characteristics set new performance standards for helix resonators. A systematic study of the effects of various surface treatments, including abuses of the cavity, is described. The tests consist of 24 liquid helium cool-downs, at 4.2^{0}K and 1.8^{0}K, of the cavity with bare and anodized Nb surfaces which at various times were electropolished, oxy-polished and heat treated. Rf and helium conditioning are discussed as techniques to get through multifactoring barriers and extend the maximum obtainable electric field. (auth)

17912 RESULTS OF MAGNET PROTOTYPE EVALUATION FOR THE FERMILAB ENERGY DOUBLER PROJECT. Strauss, B. P.; Sutter, D. F.; Ioriatti, E.; Habrylewicz, W. (Fermi National Accelerator Lab., Batavia, IL). IEEE Trans. Magn.; MAG-11: No. 2, 451-454(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The magnet fabrication and testing program was initiated in September 1972, operated the first test magnets in January 1973, settled on a shell type geometry by June 1973, tested and evaluated a matched set of dipoles by November 1973 and operated the first 6 meter, or "20 ft", prototype dipole by March 1974. The 20 ft dipole did not perform satisfactorily, reaching less than 50 percent of design current and exhibiting excessive training. Consequently, a redirection of the program channeled further efforts into a 2.5 ft model program to identify and correct the sources of difficulty and to enable resumption of 20 ft prototype construction. The first phase of the 2.5 ft program included the construction and testing of 12 magnets and is essentially complete. It led to the promise of an improved wire and a slightly more conservative magnet design that is now being used in the construction of $2^{1}/_{2}$ and 10 ft models. While the 2.5 ft model program was in active progress, two additional 20 ft prototype dipoles of the original design and one 7 ft quadrupole were completed. (auth)

17913 SUPERCONDUCTING SELF-CORRECTING HARMONIC COILS FOR PULSED SUPERCONDUCTING DIPOLE OR MULTIPOLE MAGNETS. Dael, A. (Laboratoire de l'Accelerateur Lineaire, Orsay, France); Kircher, F.; Perot, J. IEEE Trans. Magn.; MAG-11: No. 2, 459-462(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Due to the zero resistance of a superconducting wire, an induced current in a closed superconducting circuit is continuously

exactly opposed to its cause. This phenomenon was applied to the correction of the field harmonics of a pulsed magnet by putting short-circuited superconducting coils of particular symmetry in the useful aperture of the magnet. After a review of the main characteristics of such devices, the construction of two correcting coils (quadrupole and sextupole) is described. Experimental results of magnetic efficiency and time behavior are given; they are quite encouraging, since the field harmonics were reduced by one or two orders of magnitude. (auth)

17914 HIGH FIELD SUPERCONDUCTING MAGNETS FOR ACCELERATORS AND PARTICLE BEAMS. Allinger, J. (Brookhaven National Lab., Upton, NY). IEEE Trans. Magn.; MAG-11: No. 2, 463-466(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Experience in designing precision superconducting magnets for fields up to 60 kG is described, and realizable construction tolerances and their impact on field accuracy is discussed. For dipole fields up to 60 kG or more, rectangular coil window frame type magnets are compared with circular or elliptical coil designs. In all cases, the same superconductor current density versus maximum field performance is assumed. The comparison includes field quality and correction required as a function of aperture size, stored energy, ampere turns required, and overall magnet size. In quadrupole design, the impact of the allowed superconductor current density being roughly inversely proportional to peak field is severe. For gradients up to one Tesla/cm or greater, similar comparisons for different types of quadrupole construction are made. (auth)

17915 OPERATING EXPERIENCE WITH A SUPERCONDUCTING MAGNET IN A PRIMARY PROTON BEAM. Allinger, J.; Danby, G.; DeVito, B.; Hsieh, S.; Jackson, J.; Prodell, A. (Brookhaven National Lab., Upton, NY). IEEE Trans. Magn.; MAG-11: No. 2, 467-470(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Two superconducting dipole magnet modules were operated successfully at BNL since October 1973 to bend 30 GeV/c protons from the AGS by 8^0 in the new North Area beam to the 7-ft. Bubble Chamber. The magnets were energized for over 1000 hours, and, of that time, were traversed by the proton beam with beam intensities up to 5×10^{12} protons per pulse for about 750 hours. Operation of these series connected magnet units (each 2 meters long) at 35 kG was routine, even when they were intermittently subjected to beam heating of several hundred joules per pulse due to other operational beam difficulties. Experiments were also performed where copper blocks were inserted 2 meters upstream, resulting in very large interaction rates in the beam tube inside the units. A magnet quench occurred with target thicknesses such that energy approaching 1kJ per pulse was being absorbed in the system. (auth)

17916 FERMILAB CRYOGENIC ENERGY STORAGE SYSTEM. Mills, F. E. (Fermi National Accelerator Lab., Batavia, IL). IEEE Trans. Magn.; MAG-11: No. 2, 489-492(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A superconductive magnetic storage system was designed to smooth the pulsating power requirement of the Fermilab accelerator. The system stores 1 MWh and operates at peak power level of 200 MW on a 10 sec cycle. The magnetic system employs cryogenically stable superconductors and a flux-forcing normal secondary. The power system uses phase controlled thyristor rectifier-inverters similar to those employed in the main accelerator power supply. (auth)

Ion Optics and Field Calculations

Refer also to abstract 17292.

17917 (ORNL-tr-4070) MAGNETIC CYLINDRICAL LENSES WITH CORRECTED IMAGE ERROR. Hintenberger, H. Translated by E. G. Silver from Z. Naturforsch., 3a: 125-127(1948). 5p. Dep. NTIS $3.50.

The use of cylindrical electromagnetic lenses for ions and electrons is discussed, and it is shown that, by a suitable choice of the shape of the pole pieces, it is possible to achieve exact focusing. The equation for the radius of curvature is given, and, from the field boundary equations for exact focusing, it is easy to derive the conditions for focusing to any desired order. (PMA)

17918 (ORNL-tr-4071) SECOND-ORDER DIRECTIONAL FOCUSING OF CHARGED PARTICLES IN MAGNETIC FIELDS. Hintenberger, H. Translated by E. G. Silver from Z. Naturforsch., 3a: 699-670(1948). 3p. Dep. NTIS $3.50.

The conditions are given under which a divergent bundle of charged particles of identical energy and mass, emanating from a single point, can be gathered together again in a single point to second order after being bent in a homogeneous magnetic field. (PMA)

17919 ACCELERATION OF POLARIZED PARTICLES. Derbenev, Ya. S.; Kondratenko, A. M. (Inst. of Nuclear Physics, Novosibirsk, USSR). Dokl. Akad. Nauk SSSR; 223: No. 4, 830-833(1 Aug 1975). (In Russian).

In the acceleration of polarized particles to high energies in cyclic accelerators (synchrotrons), there are significant difficulties associated with the occurrence of spin resonances. In order to suppress the effects of depolarization, the dangerous harmonics of perturbing fields can be compensated or the rate of occurrence of the resonances can be increased (by decreasing the acceleration time or changing with time the oscillation frequencies of the particles during occurrence of the resonance). This study considers other possibilities based not on suppressing dangerous perturbing harmonics, but, conversely, on increasing these harmonics (by the introduction of special fields) to such a degree that the occurrence of resonances becomes adiabatic (slow). In this case after occurrence of each such resonance, the spin direction of all particles is changed to the opposite direction, while the degree of beam polarization is conserved. (SJR)

17920 DETERMINATION OF PHASE EXTENSION OF ELECTRON BUNCHES IN LINEAR ACCELERATOR. Laziev, E. M.; Oksuzyan, G. G. (Erevan Inst. of Physics). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 10: No. 3, 185-188(1975). (In Russian)

The procedure for determining the phase extension of bunches of the radiation intensity of first ten harmonics of the accelerating field frequency is described. Electron bunches pass through a set of rectangular waveguides, exciting in each the fundamental mode at the frequency of one of the harmonics. Phase extension of the bunch is obtained from the measured values of radiation power using a calculated nomogram. (auth)

17921 STUDY OF NON-LINEAR EFFECTS OF A RESONANT CAVITY ON THE LONGITUDINAL DYNAMICS OF A COASTING PARTICLE BEAM. Keil, E.; Messerschmid, E. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Instrum. Methods; 128: No. 2, 203-219(1 Oct 1975).

A computational method was developed to simulate the longitudinal motion of a relativistic beam of charged particles circulating in a strong focusing synchrotron or storage ring. Unlike most analytical approaches the simulation is not restricted to small perturbations, and the growth of instabilities can thus be followed into the non-linear region. The investigations show that, as a result of an instability, the final energy spread of an initially unbunched beam interacting with a resonant cavity is larger than the value at threshold and tends to a limit which depends on both the initial energy spread and on the spread at threshold. Although the cavity has a high impedance only at the revolution frequency of the beam, the particle distributions contain Fourier components at multiples of the revolution frequency. The growth rate and threshold agree well with those obtained from linear theory, if the cavity filling time is small compared to the growth time of the instability, and if the frequency spread within the beam is small compared to the width of the cavity resonance. (NL)

17922 FILAMENTARY INSTABILITY OF A RELATIVISTIC ELECTRON BEAM. Molvig, K. (Physics Department, University of California, Irvine, California 92664). Phys. Rev. Lett. 35: No. 22, 1504-1507 (1 Dec 1975).

The transverse electromagnetic or filamentary instability is reconsidered in light of recent experiments which were unable to suppress the instability by increasing the beam transverse temperature. I find that only the applied magnetic field can stabilize the mode. While the beam temperature can cause stabilization in a collisionless, $\nu=0$, plasma, for finite ν the beam is unstable to filamentation if $\omega_{pe}{}^2\beta^2\gamma > \Omega_{ce}{}^2$, regardless of its temperature. (auth)

Storage Rings

Refer also to abstracts 17261, 17906, and 17921.

17923 (ERDA-1546(DRAFT)) ENVIRONMENTAL STATEMENT: POSITRON-ELECTRON STORAGE RING PROJECT. (Stanford Linear Accelerator Center, Calif. (USA)). Jan 1976. vp. W. H. Pennington, Environmental and Safety, Washington, DC.

An environmental impact statement is presented for the proposed Positron-Electron colliding beam Project (PEP), a project consisting of a storage ring and experimental halls to be located

at SLAC. Environmental considerations discussed include: (1) visual impacts; (2) electric power requirements; (3) the radiological impact; (4) the impact of additional laboratory staff; (5) erosion and drainage; (6) noise control; (7) ecology; (8) traffic control; (9) economic stimulation; and (10) cultural impacts. Alternatives to the project are also discussed, including alternative sites and design. (PMA)

17924 MAGNETS FOR THE ZGS SUPERCONDUCTING STRETCHER RING. Purcell, J. R.; Wang, S. T.; Niemann, R. C.; Mataya, K. F.; Kudwig, H.; Biggs, J. A. (Argonne National Lab., IL). IEEE Trans. Magn.; MAG-11: No. 2, 455-458(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Dipoles and quadrupoles were developed for use in a 12.5 GeV storage ring at the ZGS. The winding bore of these magnets is 10.16 cm with a useful aperture of 7.6 cm. The magnets produce a high quality field (+-0.1 percent nonuniformity including the ends) that requires no correction at any field level. An operating current of 190 A at the design field of 30 kG allows the use of a very low heat leak cryostat design. A 3 meter length of magnets is expected to require only 2 liters of helium per hour. Construction of 5 prototype modules, consisting of 2 dipoles and 1 quadrupole each, complete with cryostats, is almost completed. (auth)

Experimental Facilities

17925 RECENT DEVELOPMENTS WITH CYCLOTRON-PRODUCED RADIONUCLIDES. Silvester, D. J. (Hammersmith Hospital, London). Excerpta Med. Int. Congr. Ser.; 2: 350-354 (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A review is given of radionuclides that can be produced with a cyclotron and that have suitable properties for the application in nuclear medicine. (NL)

17926 PROTON-DIFFRACTION ATTACHMENT TO ION ACCELERATORS FOR STUDYING ORIENTATIONAL EFFECTS. Markus, A. M. (Physicotechnical Inst. of Low Temperatures, Kharkov). Instrum. Exp. Tech. (USSR) (Engl. Transl.); 18: No. 3, 959-960(1975).

Translated from Prib. Tekh. Eksp.; 18: No. 3, 235-236(1975).

The layout of a compact attachment to ion accelerators for studying effects of orientation in thin and thick single crystals by "transillumination" and "reflection" proton-diffraction methods is described. By means of such a device one can register proton-diffraction patterns on 6 × 9 and 6 × 6 cm photoplates, as well as realize the electrical registration of beams scattered by an investigated object. (auth)

17927 PIEZO-ELECTRIC QUARTZ AS SUBSTRATE FOR THE PREPARATION OF SELF-SUPPORTING RARE EARTH TARGETS, IN METALLIC FORM, NOT OXIDIZED. Bonetti, C. (CEA Centre d'Etudes de Bruyeres-le-Chatel, 92-Montrouge (France)). Nucl. Instrum. Methods; 128: No. 2, 267-270(1 Oct 1975). (In French)

A technique for preparing rare earth self-supporting targets is described. These high purity foils are used for nuclear spectroscopy with a tandem Van de Graaff accelerator. Target thicknesses range from 1000μg/cm^2 to 2500μg/cm^2. The originality of this procedure consists in using the piezo-electric quartz for target thickness measurements and as a tempory substrate. With this method, it is possible to measure the target thickness without geometrical errors and to suppress the effects of the molecular flux anisotropy. (NL)

17928 ENGINEERING DESIGN AND ANALYSIS OF LARGE SUPERCONDUCTING PARTICLE ANALYSIS MAGNETS. Heim, J.; Fast, R. (Fermi National Accelerator Lab., Batavia, IL). IEEE Trans. Magn.; MAG-11: No. 2, 471-474(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Superconducting magnet technology is one phase of applied superconductivity where significant electrical power savings may be appreciated. Furthermore, these power savings may be gained without sacrificing reliability of operation or initial capital costs. The design and construction are described of 4 large superconducting dipole magnets which are being used at Fermi National Accelerator Laboratory to conduct high energy physics experiments. Two of these magnets were built and operated continuously for several months prior to installation in beam lines. Two larger superconducting dipoles are presently under construction, and both magnets will be completed this year. All magnets are designed to operate continuously without special attention, consuming approximately 10 percent of the power which would be demanded by a conventional magnet. (auth)

PHYSICS (ASTROPHYSICS AND COSMOLOGY)

Cosmic Radiation

Refer also to abstracts 17940, 17971, 18142, 18143, 18150, 18233, 18271, 18459–18467, 18475, 18488, 18489, 18491, 18496–18501, 18555, 18564, 18565, 18686, and 18863.

17929 STOCHASTIC PROCESSES IN PARTICLE-NUMBER FLUCTUATIONS IN AN ELECTRON–PHOTON SHOWER. Hinkley, S. W. (Drug Enforcement Administration, Washington, DC); Tsokos, C. Acta Biotheor.; 24: No. 1-2, 58-74(1975).

The paper is concerned with the existence and asymptotic character of the nonlinear boundary value problem: $dG/dt = f(t,G,F, abs(\alpha - \beta)) \ldots .(1)$; $abs(\alpha - \beta)\, dF/dt = g(t,G,F, abs(\alpha - \beta))$; $G(0, abs(A - \beta)) = k^1, G(inf., abs(\alpha - \beta)) = k^2 \ldots .(2)$, as $abs(\alpha - \beta)$ approaches 0^+. The discussion is related to the problem of particle-number fluctuations in the theory of cosmic radiation and G and F denote respectively the probability generating functions for the electron distribution in an electron-initiated and a photon-initiated shower. A solution of the system (1) satisfying the boundary conditions (2) is constructed so that specified limiting conditions are fulfilled. (NL)

17930 USE OF X-RAY FILMS IN EMULSION CHAMBERS. Apanasenko, A. V.; Baradzei, L. T.; Kanevskaya, E. A.; Smorodin, Yu. A.; Solov'ev, M. V.; Shcherbakova, M. N. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1656-1666(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1864-1874(Sep 1970).

Emulsion chambers are in use in many laboratories throughout the world for studying the interactions of hadrons, and they are now being employed to investigate the angular and energy distributions of muons via the emitted photons. The basic characteristics of the emulsion chambers now in use or in the planning stage are presented. (CES)

17931 IONIZATION BURST SPECTRUM AND ENERGY SPECTRUM OF NUCLEAR-ACTIVE PARTICLES AT MOUNTAIN ALTITUDES. Shestoperov, V. Ya. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1714-1717(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1927-1930(Sep 1970).

The nuclear-active particle spectrum was measured using the same method as before which consists essentially in the following. The initial data for constructing the spectrum are the spectra of the bursts registered in ionization chambers with small transverse dimensions. By using an empirical conversion factor one relates the size of a burst with the energy of the shower causing it. After certain methodological effects have been taken into account, the spectrum of the electromagnetic cascades producing the detected bursts is constructed. Finally, on the basis of measurements made with the ionization calorimeter, conversion to the energy spectrum of the nuclear-active particles is accomplished. The integral spectra of ionization bursts registered at 3200 m above sea level are presented and discussed. Also the nuclear-active energy spectrum is presented. (JFP)

17932 CALCULATIONS OF THE PASSAGE OF HIGH-ENERGY NUCLEONS THROUGH THE ATMOSPHERE WITH ALLOWANCE FOR VARIATION OF THE CHEMICAL COMPOSITION OF THE PRIMARY COSMIC RADIATION. Tret'yakova, Ch. A.; Shestoperov, V. Ya. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1717-1719(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1931-1933(Sep 1970).

All previous models are characterized by the fact that their parameters are selected on the basis of the spectra of the nuclear-active particles measured at different levels in the atmosphere. It seems that there is a direct way to explain the nuclear-active particle spectra observed in the atmosphere. Measurements made with the Proton satellites have shown that there is a change in the chemical composition of the primary cosmic rays at energies above 2×10^{12} eV. The proton fraction begins to decrease, although the combined all-particle spectrum is described by a single power law with the exponent $\gamma \approx 1.7$. Calculations were made in order to determine how this effect is reflected in the nuclear-active particle spectra in the atmosphere. It is found that perfectly definite regularities are to be expected in the energy dependence of the nucleon energy spectrum exponent and nucleon absorption length in the atmosphere. (JFP)

17933 ELECTRONS AND MUON COMPONENTS OF EAS AT MOUNTAIN ALTITUDES. Dedenko, L. G. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1757-1759(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1974-1976(Sep 1970).

The probability distribution functions for the numbers of electrons and muons with energies above 5, 10, 100, and 1000 GeV at an atmospheric depth of 690 g/cm^2 were calculated by the Monte Carlo method. The calculations were carried out in accordance with a previously proposed scheme for primary proton energies of 10^6, 10^5, and 10^4 GeV using the Cocconi model. (JFP)

17934 ABSORPTION OF COSMIC-RAY MUONS IN WATER. Vavilov, Yu. N.; Davitaev, L. N.; Trubkin, Yu. A.; Fedorov, V. M. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1759-1763(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1977-1981(Sep 1970).

Measurements of the cosmic-ray intensity deep underwater are important in two respects: they make it possible, first, to obtain the cosmic-ray muon energy spectrum at sea level in an energy region inaccessible to direct magnetic-spectrometer measurements, and second, to find the relative photonuclear losses by comparing them with analogous measurements made underground, since in such a comparison the dependence of the exponent γ in the muon energy spectrum is eliminated. Measurements of this kind have been made to depths of 3200 m underwater using a spherical diffuse-reflection Cherenkov counter with sea water as radiator. Measurements were made to depths of 1600 m in the Black Sea in June of 1968 and to 3200 m in the spring of 1969 during the 22nd cruise of the research ship "Mikhail Lomonosov": to 2000 m in the Mediterranean (36° 58.7′ N, 18° 56.7′ E) from on board the vessel and to 3200 m in the Atlantic (37° 18.5′ N, 10° 04′ W) with the equipment attached to a buoy. Energy losses and absorption curves and the mean range-energy were also calculated. (JFP)

17935 γ EMISSION FROM THE CENTER OF THE GALAXY AND SEARCH FOR BURST ACTIVITY AT $E_\gamma \geq 100$ MeV. Belyaevskii, A. I.; Bokov, V. L.; Bocharkin, V. K.; Gorodinskii, G. M.; Kruglov, E. M.; Myakinin, E. V.; Chuikin, E. I. (Ioffe Inst. of Physics and Tech., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 151-160(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 424-434(1975).

A γ telescope on the Kosmos-561 earth satellite has been used to study γ emission with $E_\gamma \geq 100$ MeV from parts of the celestial sphere with coordinates $\alpha = 0 \div 8^h$, $\delta = \pm 40°$; and $\alpha = 12 \div 20^h$; $\delta = \pm 40°$. These regions are partitioned into eight subregions. (auth)

17936 NATURE OF THE γ EMISSION FROM THE CENTER OF THE GALAXY. Stepanyan, A. A.; Vladimirskii, B. M.; Neshpor, Yu. I.; Fomin, V. P. Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 146-150(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 417-423(1975).

Data on variable γ sources with energies $>10^{12}$ eV and data on the upper limit of the diffuse γ flux from the center of the galaxy are reported. Comparison of these results with data on the γ emission in the region 10^8 eV obtained by various investigators leads to a conclusion regarding the nature of the excess radiation from the center of the galaxy. (auth)

17937 CHEMICAL COMPOSITION OF COSMIC RAYS IN THE GALAXY. Ptuskin, V. S. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 134-138(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 403-407(1975).

The transformation of the composition of cosmic ray nuclei in the interstellar medium is analyzed in the diffusion approximation. The abundance of radioactive nuclei is examined. Limitations on the possible energy dependence of the chemical composition of the cosmic rays are inferred from their pronounced isotropy. (auth)

17938 PARTICLE ACCELERATION NEAR A MAGNETIC NULL LINE. Bulanov, S. V.; Sasorov, P. V. (Lebedev Inst. of Physics,

Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 112-114 (1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 379-382(1975).

The acceleration of charged particles in a hyperbolic magnetic field and a uniform electric field is analyzed. The acceleration consists of direct acceleration by the electric field in the nonadiabatic region near the neutral line and betatron acceleration in the drift region. The characteristic energies of the accelerated particles are found in the nonrelativistic and ultrarelativistic limits. The spectra are exponential at high energies. (auth)

17939 ELEVENTH COSMIC-RAY CYCLE AND THE GENERAL SOLAR MAGNETIC FIELD. Vernov, S. N.; Charakhch'yan, A. N.; Stozhkov, Yu. I.; Charakhch'yan, T. N. (Lebedev Physics Inst., Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 63-69(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 316-324(1975).

Experimental data are reported on the time variations of the intensity of galactic cosmic rays, N(t), in interplanetary space near the earth since 1958. An empirical relationship between N(t) and the eleventh solar cycle is discussed. The sudden disruption of the correlation between N and the solar activity in 1971-1972 is interpreted as a new phenomenon of galactic-ray modulation, resulting from changes in the general solar magnetic field during this observation period. (auth)

17940 SEARCH FOR TRACES OF HEAVY AND VERY HEAVY ELEMENTS IN METEORITES. Flerov, G. N.; Otgonsuren, O.; Perelygin, V. P. (Joint Inst. for Nuclear Research, Dubna, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 120-125(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 388-394(1975).

A search for tracks due to the stopping of heavy and very heavy nuclei of the primary cosmic rays in minerals from meteorites is reported. The most suitable objects for study are olivines from meteorites of the pallasite type. Such crystals have been calibrated with accelerated heavy ions, and a study has been made of the contraction of the tracks upon annealing. The spectra of track lengths due to heavy cosmic nuclei ($Z \geq 70$) are given for olivines from the Margalahti meteorite. The possibility of obtaining the charge and energy distributions of heavy and very heavy cosmic nuclei from tracks revealed in minerals from meteorites is discussed. (auth)

17941 ELECTRIC AND MAGNETIC FIELDS ARISING FROM THE RUPTURE OF A NEUTRAL CURRENT SHEET. Somov, B. V.; Syrovatskii, S. I. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 109-111(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 375-378(1975).

The electric and magnetic fields which arise in the rupture of a neutral current sheet are determined in connection with the problem of particle acceleration in plasmas. The sheet is assumed infinitesimally thin and ideally conducting. It is shown that a singular magnetic null line arises in the rupture region. The force exerted on the edge of the "gap" which forms in the neutral sheet is calculated. (auth)

17942 SPECTRUM OF HIGH ENERGY γ-RAYS AT 690 Gcm^{-2} ATMOSPHERIC ALTITUDE. Grigorov, N. L.; Mitoyan, S. V.; Savel'eva, A. I. (Scientific-Research Inst. of Nuclear Physics, Erevan). Izv. Akad. Nauk Arm, SSR, Ser. Fiz.; 10: No. 2, 84-89(1975). (In Russian).

The experimental data on the energy and angular distributions of high energy γ-rays at mountain altitudes as obtained on the plant "ionization calorimeter with controlled nuclear photoemulsions" are given. (auth)

17943 EXTRAGALACTIC HEAVY NUCLEI IN COSMIC RAYS. Tkaczyk, W. (Lodz Univ., Poland); Wdowczyk, J.; Wolfendale, A. W. J. Phys., A (London); 8: No. 9, 1518-1529(Sep 1975).

It might be thought that if the energetic particles in the cosmic radiation are of extragalactic origin then they must be protons because heavy nuclei would be completely fragmented by interactions with the radiation fields in space. Here it is argued that this is not the case and that it is, in principle, possible to choose an origin model in which the very energetic particles commence their life as heavy nuclei; these nuclei then interact with extragalactic photons and give rise to the observed primary spectrum. Such a model would relate mainly to energies above about 10^{18} eV where there is the well known need to postulate extragalactic origin on the grounds of the observed near-isotropy of arrival directions. Specific experimental tests of models of this type are suggested. (auth)

17944 FAST MOVING SOURCES CANNOT EXPLAIN ANTINEUTRINO BURSTS. Kundt, W. (Hamburg Univ. (F. R. Germany). 1. Inst. fuer Theoretische Physik). Phys. Lett., A; 54: No. 5, 359-360(6 Oct 1975).

Special relativistic kinematics yield the upper bound $c\tau\gamma\,(1+\beta)$ on the size of a pulsed source of pulse duration τ, Lorentz factor γ. This bound conflicts with a lower bound set by Fermi statistics together with event statistics, or energy budget. (NL)

17945 DECAY CONSTANT FOR SPONTANEOUS FISSION OF ^{238}U AND ^{232}Th. Emma, V.; Lo Nigro, S. (Catania Univ. (Italy). Istituto di Fisica). Nucl. Instrum. Methods; 128: No. 2, 335-337(1 Oct 1975).

A measurement of the decay constant λ_f for spontaneous fission of ^{238}U has been carried out with the glass sandwich technique by using a thin layer of UF_4. Both the fragments of the spontaneous fission events have been made visible. From the fission track density registered after five different times of exposure from 8 to 17 months, the value $\lambda_f = (7.2 \pm 0.2) \times 10^{-17}\ y^{-1}$ has been obtained. Measurements performed on ^{232}Th allowed deducing the value $\lambda_f < 10^{-20}\ y^{-1}$. (NL)

17946 NUCLEAR COLLISIONS IN MEASUREMENTS OF THE COSMIC RAY CHARGE SPECTRUM WITH A COUNTER TELESCOPE. Lindstam, S. (Lund Univ. (Sweden). Fysiska Institutionen). Nucl. Instrum. Methods; 128: No. 2, 347-354 (1 Oct 1975).

The importance of nuclear collisions of cosmic ray particles in a counter detector telescope is studied by simple Monte Carlo techniques. The interest concentrates on the charge region just below iron and the calculations are restricted to fully relativistic cosmic rays. It is found that it is difficult to avoid a blurring in the charge spectrum from nuclear collisions leading to considerable systematic errors in some abundance ratios. (NL)

17947 ARE SOLAR NEUTRINOS DETECTED BY LIVING THINGS. Ruderfer, M. (Dimensions, Inc., 95 Madison Ave, Hempstead, New York 11550, USA). Phys. Lett., A; 54: No. 5, 363-364(6 Oct 1975).

Scattering of electrons by solar neutrinos induces an inherently detectable noise frequency approximately 100 Hz per gram of active mammalian brain tissue based on a scattering cross section previously shown to satisfactorily explain the Davis solar neutrino experiment. (NL)

17948 CAPABILITY OF COS-B TO MEASURE COSMIC γ RAY BURSTS. Boella, G. (Consiglio Nazionale delle Ricerche, Milan (Italy)); Gorisse, M.; Paul, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service d'Electronique Physique); Taylor, B. G.; Wills, R. D. (European Space Research and Technology Centre, Noordwijk (Netherlands)). Space Sci. Instrum.; 1: No. 3, 269-277(Aug 1975).

The COS-B experiment for γ ray astronomy features a large area ($1.1 m^2$) plastic scintillator, 1 cm thick, for the detection and rejection of charged particles entering the experiment. Tests with radioactive sources have confirmed that the effective area of this detector is several hundred square centimeters for the detection of γ rays of energy greater than 100 keV. For a cosmic γ ray burst of the form $I = I_0 \exp[-E/E_0]$ photons $cm^{-2}\ s^{-1}\text{-}1keV^{-1}$ with $I_0 = 1$ and $E_0 = 150$ keV, some 27,000 counts can be expected in the energy range 100-800 keV. "Noise" due to the photomultipliers and charged particles is approximately 1500 counts s^{-1}. (NL)

17949 A MEASUREMENT OF ABUNDANCES OF VVH NUCLEI ABOVE 0.6 GeV PER NUCLEON. Juliusson, E.; Meyer, P. (Enrico Fermi Institute, University of Chicago). Astrophys. J. 201: No. 1, 76-81 (1 Oct 1975).

The abundance distribution of very very heavy (VVH) nuclei just beyond the iron group has been measured with a balloon-borne counter telescope flown in 1971 and 1972. While the statistical accuracy of these observations is limited, they are nevertheless of considerable interest, since very little work has so far been done to determine the abundance of nuclei with charge between 27 and 36. It is found that the element distribution in the cosmic rays arriving at the top of the atmosphere is quite similar to the solar system abundance distribution in this interval. (auth)

17950 ON THE RELATION BETWEEN CO AND GAMMA-RAY OBSERVATIONS, COSMIC RAYS, AND THE THICKNESS OF THE GALACTIC DISK. Wentzel, D.G.; Jackson, P.D.; Rose, W.K.; Sinha, R.P. (University of Maryland). Astrophys. J. Lett. 201: No. 1, L5-L8 (1 Oct 1975).

Recent CO observations suggest that dense clouds provide a high mean gas density (mostly H_2) at approximately 5 kpc from the galactic center. Gamma-ray observations have been explained as resulting primarily from the interaction of cosmic rays with interstellar matter.

We discuss the relationship between cosmic-ray density and mean gas density, and argue that the CO clouds must be dynamically independent of the gas that is observed in 21-cm line radiation. We derive a plausible upper limit to the cosmic-ray density at $R=5$ kpc that is based on measurements of galactic disk thickness, hydrogen turbulent velocities from 21-cm line data, and an estimate of the "distributed" gas density which confines the cosmic rays to the disk. This upper limit is approximately 5 times the cosmic-ray density near the Sun. Observations of the thickness of the galactic disk suggest that the cosmic-ray density increases with distributed gas density. (auth)

17951 DETECTION OF NUCLEAR GAMMA RAYS FROM THE GALACTIC CENTER REGION. Haymes, R.C.; Walraven, G.D.; Meegan, C.A.; Hall, R.D.; Djuth, F.T.; Shelton, D.H. (Department of Space Physics and Astronomy, Rice University, Houston, Texas). Astrophys. J. 201: No. 3, 593-602 (1 Nov 1975).

On 1974 April 2 a balloon-borne measurement was undertaken of γ-rays in the 0.02–12.27 MeV energy interval from the galactic center region. A power-law continuum was observed and several spectral lines were detected for the first time, at energies close to the theoretically expected nuclear γ-rays. One ~ 10 percent broadened line was detected at an average energy of 4.6 ± 0.1 MeV. Most likely the 4.43 MeV line due to $^{12}C^*$, its flux is $(9.5\pm2.7)\times10^{-4}$ photons cm^{-2} s^{-1}. Several overlapping lines in the 1.2–2.0 MeV energy interval are present. The flux of their sum is $(2.6\pm0.6)\times10^{-3}$ photons cm^{-2} s^{-1}. The line at 0.5 MeV, which is most likely the 511 keV positron-annihilation line, has a flux of $(8.0\pm2.3)\times10^{-4}$ photons cm^{-2} s^{-1}. The nuclear γ-ray data are consistent with several models of the longitudinal distribution of low-energy cosmic rays in the Galaxy. In these models, the nuclear γ-radiation arises from the interactions of low-energy cosmic rays with the interstellar medium. (auth)

17952 WHY ARE NO RADIO PULSES ASSOCIATED WITH THE BURSTS OF CELESTIAL GAMMA-RAYS? Cavallo, G. (Laboratorio TE.S.R.E., Consiglio Nazionale delle Ricerche, Bologna, Italy); Jelley, J.V. Astrophys. J. Lett. 201: No. 3, L113-L115 (1 Nov 1975).

We discuss various interpretations of the apparent absence of radio pulses at 151 MHz in time coincidence with the *Vela* satellite γ-ray bursts. While the negative reults are consistent with either a galactic or an extragalactic origin for the γ-ray bursts, the constraints are in most cases less stringent for models based on a local or galactic origin. The absence of VHF radio pulses suggests, however, that the γ-ray bursts do not arise from stellar superflares, on the restrictive assumption that they are directly scaled-up events of solar type. (auth)

17953 THE HARD X—RAY EXPERIMENT ON THE ASTRONOMICAL NETHERLANDS SATELLITE. Gursky, H.; Schnopper, H. (Center for Astrophysics, Harvard College Observatory/Smithsonian Astrophysical Observatory); Parsignault, D. Astrophys. J. Lett. 201: No. 3, L127-L131 (1 Nov 1975).

The Hard X-ray Experiment flown on the Astronomical Netherlands Satellite is described. The experiment consists of two parts. One is a large-area detector of about 60 cm^2 total area, sensitive in the energy range 1.5–30 keV. Two counters comprise this detector, each collimated, by $10°\times3°$ and offset in the narrow direction by 4°. The other part is a Bragg crystal assembly consisting of two PET crystals and counters aligned to search for the silicon emission lines near 2 keV. Instrument characteristics and orbital operations are described. (auth)

17954 THE COSMIC-RAY AGE DEDUCED FROM THE ^{10}Be ABUNDANCE. Garcia-Munoz, M.; Mason, G.M.; Simpson, J.A. (Enrico Fermi Institute, University of Chicago). Astrophys. J. Lett. 201: No. 3, L141-L144 (1 Nov 1975).

We report the first satellite measurements of the radioactive cosmic-ray species ^{10}Be. The abundance was measured near 100 MeV per nucleon with high-resolution solid-state telescopes on the IMP-7 and IMP-8 satellites during 1973–1974. These two independent measurements yield ^{10}Be/Be ratios of less than 10 percent. Taken together with the galactic propagation model described in the text, these results show that the cosmic-ray "clock" lifetime (most probable value of $\sim2\times10^7$ years) is significantly greater than that deduced for a nominal interstellar gas density of ~1–3 atoms cm^{-3}. (auth)

17955 THE ISOTOPIC COMPOSITION OF GALACTIC COSMIC-RAY LITHIUM, BERYLLIUM, AND BORON. Garcia-Munoz, M.; Mason, G.M.; Simpson, J.A. (Enrico Fermi Institute, Universiy of Chicago). Astrophys. J. Lett. 201: No. 3, L145-L148 (1 Nov 1975).

The isotopes of cosmic-ray Li, Be, and B near 100 MeV per nucleon have been measured with cosmic-ray telescopes on board the IMP-7 and IMP-8 satellites during 1973–1974. The measured isotopic abundances provide a stringent test for models of interstellar propagation and solar modulation. It is found that the isotopic abundances can be explained using a steady-state interstellar propagation model with a 5 g cm^{-2} leakage mean free path. These results, taken along with our ^{10}Be abundance measurements, indicate a longer lifetime for cosmic rays than that predicted by the usual assumption of an average interstellar density of 1 to 3 atoms cm^{-3}. (auth)

17956 THE ANOMALOUS ^{4}He COMPONENT IN THE COSMIC-RAY SPECTRUM AT $\lesssim$ 50 MeV PER NUCLEON DURING 1972–1974. Garcia-Munoz, M.; Mason, G.M.; Simpson, J.A. (Enrico Fermi Institute, University of Chicago). Astrophys. J. 202: No. 1, 265-275 (15 Nov 1975).

When the current solar cycle approached near minimum modulation in 1972, we found that during solar quiet times the low-energy cosmic-ray proton spectrum had a typically steep form, while the helium spectrum had evolved into a "flat" form not observed before, such that at low energies the ratio ^{4}He/^{1}H became $\gtrsim 1$. This paper reports a further study of these spectra by comparing them with the spectra of several other cosmic-ray species, including ^{3}He and B which are of known galactic origin. This comparison shows that, except for ^{4}He, all the species have similar forms. The paper also reports the determination of solar modulation parameters (e.g., diffusion coefficient, size of the heliosphere) and a set of local interstellar spectral forms which result in a self-consistent fit of the 1973 spectra of electrons, protons, and heavier nuclei, except for ^{4}He $\lesssim$ 50 MeV per nucleon. The low-energy ^{4}He flux is found to be in excess of the level expected for a period of more than 2 years. We show that it is difficult to argue that the lack of fit to the ^{4}He spectrum is due to a breakdown in solar modulation theory at low magnetic rigidities ($\lesssim 0.1$ GV). It is concluded that the excess ^{4}He flux is due to an anomalous component which probably is related to the 1972–1973 N and O quiet-time anomalous components observed at $\lesssim$ 20 MeV per nucleon. The paper includes a comparison of the ^{1}He and ^{4}He behavior in the phase-lag effect of the low-energy galactic cosmic-ray fluxes versus the Climax neutron monitor intensities. These studies have been based on measurements from the University of Chicago instruments on the satellites IMP 3, 4, 5, 7, and 8 covering the period 1965–1974. (auth)

17957 "ON THE RELATION BETWEEN CO AND GAMMA-RAY OBSERVATIONS, COSMIC RAYS, AND THE THICKNESS OF THE GALACTIC DISK": A COMMENT. Mouschovias, T.C. (Department of Astrophysical Sciences, Princeton University). Astrophys. J. Lett. 202: No. 1, L1-L3 (15 Nov 1975).

We point out that on both theoretical and observational grounds molecular clouds are not dynamically decoupled from the rest of the interstellar medium. This removes the complications raised in the paper by Wentzel *et al.* We discuss some theoretical difficulties with the stratified model of the interstellar medium, and we cite observational evidence against it. Finally, we comment on the suggestion by Wentzel *et al.* that the latitude distribution of γ-rays implied by the stratified model is similar to that of H I. (auth)

17958 COSMIC GAMMA-RAY BURSTS. Strong, I. B. (Los Alamos Scientific Lab., NM). pp 47-58 of Neutron Stars, Black Holes, and Binary X-Ray Sources. Gursky, H. (ed.). Dordrecht, Netherlands; D. Reidel Publishing Co. (1975).

The recent discovery by the Vela satellite system of short, extremely intense, bursts of gamma rays originating outside the solar system, and the subsequent confirmation by a number of other independent observers, are described. The known properties of these so-called gamma-ray bursts are given together with outlines of some of the more promising explanations produced so far. Essentially all these explanations invoke compact stellar objects—that is, dwarf stars, neutron stars or black holes. (auth)

17959 STATISTICAL ANALYSIS OF THE 27-DAY QUASI-PERIODICITY OF THE INTENSITY OF THE NEUTRON COMPONENT OF COSMIC RAYS. Akhababyan, N.; Yordanova, Y.; Kirov, I. (Inst. of Nuclear Research and Nuclear Power Engineering, Sofia). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 808-814(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 955-963(1974).

Three statistical methods for analyzing random time series, i.e., Buys Ballot's linear transformation, the correlation transformation, and spectral analysis, are compared on the basis of an analysis of average daily intensities of the neutron component of cosmic rays for the period from January to December 1970. The correlation transformation shows that the time series under study are stationary within the period in question and are not purely random with 99% probability. Buys Ballot's method and spectral analysis indicate the existence of a component with a period of 28 days. (auth)

17960 NITROGEN AND OXYGEN ISOTOPES IN THE LOW ENERGY COSMIC RAYS. Vidor, S. B. Pasadena, CA; California Inst. of Tech. (1975). 162p. University Microfilms Order No. 75-25,849.

Thesis (Ph. D.).

The isotopic composition of the enhanced low energy nitrogen and oxygen cosmic rays can provide information regarding the source of these particles. Using the Caltech Electron/Isotope Spectrometer aboard the IMP-7 satellite, a measurement of this isotopic composition was made. Corrections to the standard range-energy tables were obtained which can be used to calculate the isotope response of this and similar instruments. The low

energy nitrogen and oxygen cosmic rays were determined to be primarily ^{14}N and ^{16}O. Upper limits were obtained for the abundances of the other stable nitrogen and oxygen isotopes. To the 84 percent confidence level the isotopic abundances are: $^{15}N/N$ less than or equal to 0.26 (5.6 to 12.7 MeV/nucleon), $^{17}O/O$ less than or equal to 0.13 (7.0 to 11.8 MeV/nucleon), $^{18}O/O$ less than or equal to 0.12 (7.0 to 11.2 MeV/nucleon). The nitrogen composition differs from higher energy measurements which indicate that ^{15}N, which is thought to be secondary, is the dominant isotope. This implies that the low energy enhanced cosmic rays are not part of the same population as the higher energy cosmic rays and that they have not passed through enough material to produce a large fraction of ^{15}N. The isotopic composition of the low energy enhanced nitrogen and oxygen is consistent with the local acceleration theory of Fisk, Kozlovsky, and Ramaty, in which interstellar material is accelerated to several MeV/nucleon. If, on the other hand, the low energy nitrogen and oxygen result from nucleosynthesis in a galactic source, then the nucleosynthesis processes which produce an enhancement of nitrogen and oxygen and a depletion of carbon are restricted to producing predominantly ^{14}N and ^{16}O. (Diss. Abstr. Int., B)

Stars

Refer also to abstracts 17958, 18078–18082, 18087, 18088, 18097–18101, 18103, 18108, 18146, 18183, 18189, 18203, 18204, 18639, 19228, 19236, and 19366.

17961 NEUTRAL CURRENTS AND NEUTRINO EMISSION BY STARS. Gershtein, S. S.; Folomeshkin, V. N.; Khlopov, M. Yu.; Eramzhyan, R. A. (Inst. of High Energy Physics, Serpukhov, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 4, 1121-1126(Oct 1975). (In Russian)

The possibility of $\nu_e\tilde{\nu}_e$ and $\nu_\mu\tilde{\nu}_\mu$ pair emission in collisions between nucleons or in nuclear transitions is considered. Emission of neutrino pairs in neutron collisions is essential for cooling of neutron stars. Neutrino pair emission in nuclear transitions is found to be efficient immediately prior to implosion of the nucleus of the hot massive star and during the initial stage of implosion (up to complete dissociation of the nucleus into nucleons). (auth)

17962 MODELS OF UPPER MAIN SEQUENCE STARS CONTAINING A TOROIDAL COMPONENT OF MAGNETIC FIELD. Moss, D. L. (Manchester Univ., Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 141-160(Oct 1975).

Models appropriate to upper main sequence stars in strict radiative equilibrium with linked toroidal and poloidal magnetic fields are constructed. For most of the calculations the poloidal field is assumed to be strictly dipolar. Models are found with comparable poloidal and toroidal fluxes, and it is plausible that some are stabilized against the instabilities experienced by a purely poloidal field in the neighbourhood of the neutral line. However, it does not seem that models calculated by this method will be dynamically prolate, as may be necessary to explain the large inclination of magnetic and rotational axes in many of the observed magnetic stars. This may only be a consequence of some rather arbitrary assumptions that have been made about the relation between the toroidal and poloidal fields. Some calculations were made including a P_3 component of radial field and from these it seems plausible that the procedure used converges reasonably quickly. (auth)

17963 NON-LTE TRANSFER. Root Epsilon Revisited. Frisch, U.; Frisch, H. (Observatory de Nice, France). Mon. Not. R. Astron. Soc.; 173: No. 1, 167-182(Oct 1975).

Assuming a semi-infinite atmosphere, a two-level atom and complete frequency redistribution, a new derivation is given, in the isothermal case, of the surface value of the source function based only on the integral equation for the source function. This derivation has a straightforward extension to the case where a uniform velocity gradient is included, to the time-dependent case (thermal source B switched on at time t = 0) and to the determination of the mean number of scatterings undergone by an escaping photon (with Ambartsumian's definition). The derivation suggests also a simple approximate differential equation for the complete source function $\partial(P^{\frac{1}{2}}S)/\partial\tau = \epsilon P^{-\frac{1}{2}}\partial B/\partial\tau$, where $P = \epsilon + (1-\epsilon)K_2(\tau)$ and $K_2(\tau)$ is the direct escape probability for outwards emitted photons. This approximation is tested both for isothermal and exponential atmosphere. As long as the scale of B is large compared to the photon mean free-path at the center of the line, the approximation reproduces all the qualitative features and is usually slightly in excess of the exact solution. The approximation is easily extended to non-uniform ϵ and multilevel atoms. (auth)

17964 EFFECT OF ENERGY GENERATION FLUCTUATIONS ON THE ONSET OF THERMAL INSTABILITY IN A BOUSSINESQ FLUID SPHERE. Edwards, A. C. (Royal Observatory, Edinburgh). Mon. Not. R. Astron. Soc.; 173: No. 1, 207-221(Oct 1975).

The Boussinesq perturbation equations are modified to include the effect of energy generation fluctuations. The equations are then solved for the motion within a sphere of radius R subject to free and rigid boundary conditions. A transcendental equation is derived connecting the growth rate, Rayleigh number, Prandtl number and an energy generation number for each mode. Various cases are considered for the $l = 1$ mode with free boundary conditions and a good approximation is given for the Rayleigh number at high energy generation rates. (auth)

17965 MASS LOSS FROM RED GIANTS IN OLD OPEN CLUSTERS. Hawarden, T. G. (Schmidt Telescope Univ., Coonabarabran, New South Wales, Australia). Mon. Not. R. Astron. Soc.; 173: No. 1, 223-229(Oct 1975).

The stars of the giant branch clump or red horizontal branch in all members of a sample of six open clusters older than the Hyades are found to be less concentrated towards the cluster center than the stars of the upper main sequence. In the cluster NGC 2158 the effect is very prominent and is shown to be a real physical property of the cluster. A similar apparently strong effect in NGC 2477 may, however, be a consequence of a systematic variation of reddening with radial position in the cluster. The fact that at least five of the six old clusters studied show the deconcentration phenomenon in the same sense is taken as evidence that the phenomenon is a general property of the horizontal branches of Population I systems. It is argued that the phenomenon is a consequence of mass loss during the most luminous phases of red giant evolution, probably by a stellar wind mechanism. (auth)

17966 SEARCH FOR OLD SOUTHERN OPEN CLUSTERS. Hawarden, T. G. (Royal Observatory, Cape Town, S. Afr.). Mon. Not. R. Astron. Soc.; 173: No. 1, 231-235(Oct 1975).

The methods used to identify old open clusters are described and results are given for the clusters studied. A catalogue of clusters older than $\sim 4 \times 10^8$yr is presented. There appears to be a deficiency of old clusters in the direction of the galactic center and an excess in the anticenter direction. (auth)

17967 COPERNICUS: X-RAY OBSERVATIONS OF SEVERAL RADIO SUPERNOVA REMNANTS. Zarnecki, J. C.; Stark, J. P.; Charles, P. A.; Culhane, J. L. (Mullard Space Science Lab., Dorking, Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 103-109(Oct 1975).

The MSSL X-ray detectors on Copernicus have observed five radio sources, 3C 392, DR4, MSH 15-52A and Downes Nos 83 and 84 in the energy range 0.5 to 7.5 keV. The first three objects are thought to be supernova remnants. Upper limits are presented from the observations and in the case of 3C 392 a possible positive detection of X-ray emission. The variability of the X-ray source 3U 1901 + 03 is also discussed. (auth)

17968 GRAVITY DARKENING IN MAGNETIC STARS. Smith, R. C. (Univ., Sussex, Brighton, Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 97-102(Oct 1975).

The technique of a previous paper is used to evaluate the gravity darkening in some published models of rotating magnetic stars. For most of the models studied, there is only a small departure from the von Zeipel relation. However, for stars with a large ratio of magnetic to rotational energy the variation of emergent flux with gravity could be quite strong. This could be relevant for a few Ap stars. (auth)

17969 MOMENTUM AND ENERGY TRANSFER BY NEUTRINO RADIATION TO THE MANTLE OF A COLLAPSING STAR AND SUPERNOVAE EXPLOSIONS. Gershtein, S. S.; Imshennik, V. S.; Nadezhin, D. K.; Folomeshkin, V. N.; Khlopov, M. Yu.; Chechetkin, V. M.; Eramzhyan, R. A. (Inst. of High Energy Physics, Serpukho, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1473-1483(Nov 1975). (In Russian).

Various mechanisms of energy and momentum transfer in mantles of massive collapsing stars are discussed, including coherent scattering of neutrinos by nuclei due to neutral currents. It is concluded that the mechanisms considered are ineffective in supernovae explosions. It is pointed out that in small-mass ($M < 2M_\odot$) collapsing carbon–oxygen stars the neutrino radiation of the central nucleus heats the mantle matter to temperatures which are sufficient for ignition of carbon and oxygen. This may result in ejection of the star mantle and hence in a supernova explosion. The main heating mechanism is scattering of neutrinos by electrons. The efficiency of such heating is very great since under the physical conditions the electron gas is degenerate and possesses a relativistic Fermi energy. (auth)

17970 MOTION OF PULSARS AND BLACK HOLES. Galkin, S. L. (All-Union Scientific Research Inst. of Optical-Physical Measurement, Moscow). Dokl. Akad. Nauk SSSR; 223: No. 4, 827-829(1 Aug 1975). (In Russian).

Pulsars (neutron stars) and black holes have been predicted by the general relativity theory (GRT). In this theory a substantial characteristic of a body is its gravitational radius $r_g = 2\gamma M/c^2$, where M is the gravitational mass of the body. If R is the radius of a body, then the ratio $\alpha = r_g/R$ plays an important role. For ordinary astronomical bodies $\alpha \ll 1$; for neutron stars $\alpha < 1$, and for black holes $\alpha \to 1$. These bodies are respectively nonrelativistic, relativistic and ultrarelativistic. The motion of nonrelativistic bodies is described by the equations of celestial mechanics. The motion of relativistic objects (pulsars and black holes) are obtained from GRT, but the equations of motion are not explicitly contained in the Einstein field equations. It is shown that without making any additional assumptions the motion of a black hole does not obey the equations of celestial mechanics. With actual observations on double stars in mind, it is assumed that the distances between the bodies are much greater than the gravitational radii. This discussion is presented to prove that in the general case of a binary system including a black hole the motion of the black hole should not be described by the equations of celestial mechanics. This point of view is important today, because in identifying a known body of Cyg X 1 with a black hole, substantial use was made of the applicability of the equations of celestial mechanics to this body. (SJR)

17971 MAGNETIC-FIELD FORMATION AND CHARGED-PARTICLE ACCELERATION IN A BINARY STAR SYSTEM. Dolginov, A. Z. (Ioffe Inst. of Physics and Tech., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 92-95(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 354-358(1975).

Two possibilities for the formation of a magnetic field in a binary star system are analyzed: the field is formed by tidal forces; the field is formed as a result of the mutual induction as the stars turn on their axes and move through their orbits. It is shown that particles can be accelerated to relativistic energies in the magnetic field of a binary system. (auth)

17972 NONLINEAR EFFECTS IN THE EMISSION OF INTERSTELLAR MOLECULES. Smirnov, G. I. (Inst. of Automation and Electrometry, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 1, 3-8(Jul 1975). (In Russian).

The effect of depolarizing collisions and interference of molecular states on the emission parameters of cosmic OH masers (intensity, polarization, and spectral line shape) is considered. It is shown, in particular, that on interaction between the saturated radiation of the principle lines and the satellite lines narrow interference dips of the Raman type appear on the satellite amplification contour, their widths and amplitudes increasing with growth of amplification. Circular polarization of solitary satellites are interpreted as being due to the action of shock broadening. (auth)

17973 BUBBLE METHOD OF STABILITY ANALYSIS. Smith, R. C. (Sussex Univ., Brighton, Eng.); Fricke, K. J. Mon. Not. R. Astron. Soc.; 172: No. 3, 577-584(Sep 1975).

In a recent paper, Simon has used a "bubble method" to investigate the secular stability of stellar differential rotation and has obtained a weaker criterion for stability than the Goldreich-Schubert-Fricke (GSF) criterion, which was based on a local (plane-wave) analysis. It is pointed out that Simon's treatment involves a restriction on the class of perturbations considered. A more general bubble method is formulated and the GSF criterion is recovered, thus resolving the contradiction found by Simon. (auth)

17974 EQUATIONS GOVERNING THE AXISYMMETRIC PERTURBATIONS OF THE KERR BLACK HOLE. Chandrasekhar, S. (Univ. of Chicago); Detweiler, S. Proc. R. Soc. (London), Ser. A; 345: No. 1641, 145-147(30 Aug 1975).

It is shown how Teukolsky's equation, governing the perturbations of the Kerr black hole, can be reduced, in the axisymmetric case, to a one-dimensional wave equation with four possible potentials. The potentials are implicitly, dependent on the frequency, and besides, depending on circumstances, they can be complex. In all cases (i.e. whether or not the potentials are real or complex), the problems of the reflection and the transmission of gravitational waves by the potential barriers can be formulated, consistently, with the known conservation laws. It is further shown that all four potentials lead to the same reflection and transmission coefficients. (auth)

17975 SUPERCRITICAL FIELDS AND BALD BLACK HOLES. Irvine, J. M. (State Univ. of New York, Buffalo). J. Phys., A (London); 8: No. 10, L117-L120(Oct 1975).

The instability of a many-fermion ground state against particle-hole excitations is reviewed and the existence of supercritical electromagnetic and strong interaction fields is briefly discussed. The nature of associated phase changes and in particular the change in conservation laws which accompanies the phase changes is outlined. Finally, the supercritical gravitational field is considered and weight given to the argument that "black holes have no hair." (auth)

17976 NEUTRON REACTIONS IN STARS. Vlasov, N. A. At. Energ. (USSR); 39: No. 2, 103-108(Aug 1975). (In Russian).

The physical conditions for the existence of matter in stars at various stages of evolution, the process of neutronization in the course of evolution, and features of nuclear reactions under such conditions are discussed. The results of observations and their relationship to characteristics of nuclear reactions under conditions of high density and temperature are examined. (4 figures, 2 tables, 17 references.) (auth)

17977 THE PRIMORDIAL BLACK HOLE MASS SPECTRUM. Carr, B.J. (Department of Applied Mathematics and Theoretical Physics, Cambridge University, Cambridge, England). Astrophys. J. 201: No. 1, 1-19 (1 Oct 1975).

We examine what mass spectrum of primordial black holes should result if the early universe consisted of small density fluctuations superposed on a Friedmann background. It is shown that only a certain type of fluctuation favors the formation of primordial black holes and that, consequently, their spectrum should always have a particular form. Since both the fluctuations which arise naturally and the fluctuations which are often invoked to explain galaxy formation are of the required type, primordial black holes could have had an important effect on the evolution of the universe. In particular, although primordial black holes are unlikely to have a critical density, big ones could have been sufficiently numerous to act as condensation nuclei for galaxies. Observational limits on the spectrum of primordial black holes place strong constraints on the magnitude of density fluctuations in the early universe and support the assumption that the early universe was nearly Friedmann rather than chaotic. Any model in which the early universe has a soft equation of state for a prolonged period is shown to be suspect, since primordial black holes probably form too prolifically in such a situation to be consistent with observation. (auth)

17978 CO MAPPING AND ANALYSIS OF THE V1057 CYGNI REGION. Bechis, K.P. (Department of Physics and Astronomy, University of Massachusetts, Amherst); Lo, K.Y. Astrophys. J. 201: No. 1, 118-133 (1 Oct 1975).

We have mapped emission lines from the $J=1$–0 rotational transitions of $^{12}C^{16}O$ and $^{13}C^{16}O$ in the vicinity of the unusual star V1057 Cygni and its reflection nebula. The emission lines, all peaking in intensity at +4.1 km s^{-1} (with respect to the local standard of rest), are fairly narrow; the full widths at half-maxima for $^{12}C^{16}O$ never exceed 3 km s^{-1}, and those for $^{13}C^{16}O$ never exceed 1.5 km s^{-1}. Lower limits for the $^{12}C^{16}O$ optical depths over the region range from 40 to over 120. Therefore the gas kinetic temperatures approximate or have as a lower limit the excitation temperatures, which lie between 9 and 15.5 K over the entire region surveyed at both line frequencies (an approximately square area $4' \times 4'$ centered on the star's position). The optical depths are significantly correlated with the visual appearance of the reflection nebula. The angular distribution of the $^{13}C^{16}O$ antenna temperatures, and of values for the $^{12}C^{16}O$ column densities, also appear to be well correlated with the reflection nebula. The angular distribution of the $^{12}C^{16}O$ peak antenna temperatures appears not to be significantly correlated with the reflection nebula. We interpret the reflection nebula as a cometary- or fan-shaped nebula aligned with its apex (close to which the star is located) facing the Earth, and its major axis nearly along our line of sight. The cometary shape of the nebula may be caused in part by interaction with a magnetic field of up to 1.5×10^{-3} gauss in this region. (auth)

17979 UV STARS AND THE INTERSTELLAR MEDIUM: A STATISTICAL TIME-DEPENDENT MODEL. Lyon, J. (Princeton University Observatory). Astrophys. J. 201: No. 1, 168-178 (1 Oct 1975).

A statistical time-dependent model for the effects on the interstellar gas of the ionizing radiation from UV stars is presented. The radiation from the stars is assumed to come out as monochromatic bursts at random times and locations. The thermal and ionization history of the gas is followed in a Monte Carlo simulation. Probability densities as well as mean values for the ionization fraction, temperature, and other observable quantities are derived. The fluctuations in observed quantities due to the stochastic nature of the model are estimated. Models of the interstellar medium perpendicular to the galactic plane are made and compared with observations. The action of the UV stars can explain the bulk properties of the interstellar gas toward the galactic poles and is consistent with the *Copernicus* satellite observations toward λ Scorpii. (auth)

17980 PI AQUARII: A PULSATING Be STAR? Fernie, J.D. (David Dunlap Observatory, University of Toronto, Richmond Hill, Ontario, Canada). Astrophys. J. 201: No. 1, 179-182 (1 Oct 1975).

Following the discovery by Ringuelet and Machado of large periodic radial-velocity variations in π Aqr, photometric observations of the star have been obtained. It is found that the star has undergone small but significant secular changes in brightness and color since observations made 11 years earlier, and that it also shows instabilities of the order of several hundredths of a magnitude on a time scale of hours or less. Several possible explanations, such as rotation, presence of a binary companion, varying emission lines, and pulsation, are considered. Of these, only pulsation seems plausible. (auth)

17981 ON SHALLOW CONVECTIVE ENVELOPES. Deupree, R.G. (David Dunlap Observatory, Richmond Hill, Ontario, Canada). Astrophys. J. 201: No. 1, 183-189 (1 Oct 1975).

Three-dimensional (two spatial dimensions and time) partial differential equations of mass, momentum, and energy conservation have been integrated numerically by finite difference techniques over a sufficiently long time interval to allow convective motion to develop from computer round-off error. Adiabatic motion is *not* assumed. Except where specifically mentioned, we confine attention to linear results, by which we mean that the processes that limit convection are negligible. The effects of several assumptions are discussed, and the method of solution is applied to a particular situation in which most of the assumptions are well satisfied: a shallow convective envelope with extensive convective motion only in the second helium ionization zone. The size of the convective cells, the evidence for the existence of only one growth rate of the convective motion, the pressure perturbations, and the effects of nonadiabaticity are discussed. A comparison between the convective flux predicted by the computations and that from the standard mixing length theory is made, in which it is found that the mixing length theory predicts too little convective flux near the upper boundary of the convective region. Finally, the effects of nonlinear terms are discussed, and it is found that these terms tend to drive the convective motion toward a steady state, even though the particle and radiative viscous dissipation is negligible on this scale of motion. (auth)

17982 A SIMPLE MODEL FOR THE EARLY PART OF TYPE I SUPERNOVA LIGHT CURVES. Lasher, G. (IBM Thomas J. Watson Research Center, Yorktown Heights, New York). Astrophys. J. 201: No. 1, 194-201 (1 Oct 1975).

A simple hydrodynamic and gray radiation diffusion model is used to fit the first 40 days of the Type I supernova light curve. The model requires only three input parameters: the density and mass of the envelope of the parent star and the energy which is presumed to be deposited at the center of the envelope by the collapse of the core. A density of 10^{-8} g cm^{-3}, a mass of $2\,M_\odot$, and an energy of 10^{51} ergs gives a model fitting observed values of the maximum magnitude, the duration of the light curve 1 mag below maximum, and a final velocity of the photosphere of 10^9 cm s^{-1}. (auth)

17983 NEUTRONIZATION AND THERMAL DISINTEGRATION OF DENSE STELLAR MATTER. Epstein, R.I. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory); Arnett, W.D. Astrophys. J. 201: No. 1, 202-211 (1 Oct 1975).

The properties of matter in nuclear statistical equilibrium are investigated over the range of density, temperature, and electron number $10^9 \lesssim \rho \lesssim 10^{11}$ g cm^{-3}, $2 \times 10^9 \lesssim T \lesssim 4 \times 10^{10}$, and $0.50 \lesssim Y_e \lesssim 0.45$; it is just this range of parameters which is relevant for stellar material subsequent to silicon burning. The ion number, the nuclear binding energy; and the rates of neutronization and energy emission by neutrinos have been calculated. The present results are compared with those of previous workers, and their accuracy is critically assessed. A simple phenomenological picture of the relevant physical processes is presented and is used to develop approximate expressions for the weak interaction rates and the thermodynamic properties of the matter. The approximate results are presented in a form which is suitable for numerical investigations. (auth)

17984 STELLAR MODEL CHROMOSPHERES. IV. THE FORMATION OF THE Hϵ FEATURE IN THE SUN (G2 V) AND ARCTURUS (K2 III). Ayres, T.R.; Linsky, J.L. (Joint Institute for Laboratory Astrophysics, University of Colorado). Astrophys. J. 201: No. 1, 212-221 (1 Oct 1975).

The formation of the Balmer series member Hϵ in the near red wing of the Ca II H line is discussed for two cases: the Sun (Hϵ absorption profile) and Arcturus (Hϵ absorption profile). It is shown that although the Hϵ source functions in both stars are dominated by the Balmer continuum radiation field through photoionizations, the line formation problems in the two stars are quantitatively different, owing to a substantial difference in the relative importance of the stellar chromosphere temperature inversion compared with the stellar photosphere. (auth)

17985 RESONANCE LINE TRANSFER WITH PARTIAL REDISTRIBUTION. VI. THE Ca II K-LINE IN SOLAR-TYPE STARS. Shine, R.A. (Laboratory for Atmospheric and Space Physics, University of Colorado, Boulder); Milkey, R.W.; Mihalas, D. Astrophys. J. 201: No. 1, 222-224 (1 Oct 1975).

Using model atmospheres for solar-type stars based on scaled temperature distributions, we discuss the effects of partial frequency redistribution on the Ca II K-line profiles. We show that the partial redistribution calculations lead to a significantly lower intensity at K_1 than given by calculations based on the assumption of complete redistribution. This implies that fits to observed fluxes with complete redistribution calculations could tend to underestimate systematically the value of the temperature at the chromospheric temperature minimum. (auth)

17986 MICROWAVE H_2O EMISSION FROM YOUNG STARS. Schwartz, P.R. (E. O. Hulburt Center for Space Research, Naval Research Laboratory); Buhl, D. Astrophys. J. Lett. 201: No. 1, L27-L28 (1 Oct 1975).

H_2O emission has been detected from the Ae or Be stars HD 250550, LkHα 234, and LkHα 198. Comparison of the H_2O velocity with that of associated interstellar CO indicates that the H_2O originates in an infall region, possibly the contracting parent cloud. H_2O emission has also been detected in OH 205.1–14.1, an OH source near the T Tauri star LkHα 308. (auth)

17987 PROBLEMS IN CLASSIFYING COOL DEGENERATE STARS. Hintzen, P.; Strittmatter, P.A. (Steward Observatory, University of Arizona). Astrophys. J. Lett. 201: No. 1, L37-L40 (1 Oct 1975).

It is shown from model atmosphere calculations that cool, hydrogen-rich degenerate stars may readily be confused spectroscopically with subdwarfs. Many faint, cool, high-proper-motion stars currently classified as subdwarfs may thus turn out to be cool degenerates. Empirical studies of white-dwarf cooling times which do not take this into account may be in serious error. (auth)

17988 PRODUCTION OF ^{17}O AND ^{18}O BY MEANS OF THE HOT CNO TRI-CYCLE. Cowan, J.J.; Rose, W.K. (Astronomy Program, University of Maryland). Astrophys. J. Lett. 201: No. 1, L45-L48 (1 Oct 1975).

We study high-temperature ($T \geq 10^8$ K) CNO cycle burning. We find an overabundance of both ^{17}O and ^{18}O after times of approximately 10^2 seconds. For temperatures of 150 and 200 million degrees we find that the ^{18}O abundance is much larger than the ^{17}O abundance after burning times of about 10^3 seconds. Known uncertainties in the nuclear reaction rates do not alter our conclusions. (auth)

17989 THE DISTRIBUTION OF SUPERNOVA REMNANTS IN THE GALAXY: EVIDENCE FOR A TUNNEL SYSTEM. Jones, E.M. (University of California, Los Alamos Scientific Laboratory). Astrophys. J. 201: No. 2, 377-380 (15 Oct 1975).

Counts of supernova remnants are used to derive the supernova rate, average remnant evolution, and probability that a remnant encounters a hot, low-density tunnel in the interstellar medium. The results suggest that tunnels occupy about 80 percent of the galactic volume. We further find that the remnants in the inner parts of the Galaxy may be in a later stage of evolution than the average remnant in the outer parts of the Galaxy. (auth)

17990 ISOTHERMAL BLAST WAVE MODEL OF SUPERNOVA REMNANTS. Solinger, A.; Rappaport, S.; Buff, J. (Physics Department and Center for Space Research, Massachusetts Institute of Technology). Astrophys. J. 201: No. 2, 381-386 (15 Oct 1975).

The validity of the "adiabatic" assumption in supernova remnant calculations is examined, and the alternative extreme of an isothermal blast wave is explored. We conclude that, because of thermal conductivity, the large temperature gradients predicted by the adiabatic model probably are not maintained in nature. Self-similar solutions to the hydrodynamic equations for an isothermal blast wave have been found and studied. These solutions are then used to determine the relationship between X-ray observations and inferred parameters of supernova remnants. A comparison of the present results with those for the adiabatic model indicates differences which are less than present observational uncertainties. We conclude that most parameters of supernova remnants inferred from X-ray measurements are relatively insensitive to the specifics of the blast wave model. (auth)

17991 PULSATION PROPERTIES OF UPPER-MAIN-SEQUENCE STARS. Aizenman, M.L.; Hansen, C.J.; Ross, R.R. (Joint Institute for Laboratory Astrophysics, University of Colorado and National Bureau of Standards). Astrophys. J. 201: No. 2, 387-391 (15 Oct 1975).

The pulsation properties of zero-age main-sequence stars having an initial chemical composition X=0.72, Y=0.25, Z=0.03 are determined for stars in the mass range $10 \leq M/M_\odot \leq 110$. Radial and nonradial modes (l=1,2) are considered in some detail. It is found that for this composition pulsational instability occurs only in the radial fundamental mode for $M \gtrsim 60\,M_\odot$. All nonradial modes examined are found to be stable, as are the radial harmonic oscillations. At the onset of instability, the ratio of the fundamental radial mode to the radial first

harmonic, or nonradial p_1 mode, is very nearly 2. It is suggested that this commensurability leads to mode coupling which may dissipate the pulsation energy of the unstable radial mode. (auth)

17992 CO IN THE INFRARED AND RADIO SPECTRA OF CARBON STARS. Frogel, J.A.; Dickinson, D.F. (Center for Astrophysics, Harvard College Observatory, and Smithsonian Astrophysical Observatory); Hyland, A.R. Astrophys. J. 201: No. 2, 392-396 (15 Oct 1975).

Spectral scans from 2.0 to 2.5 μ of many of the reddest sources in the Two-Micron Sky Survey have resulted in the identification of eight new carbon stars, five of which have subsequently been identified by other observers. These and other known carbon stars have been searched for 2.6-mm CO emission. A broad emission line, similar to that in IRC+10216, has been found in IRC+40540.IRC−20131 and IRC+50338 (V Cyg) show narrow CO lines whose origin is probably interstellar. (auth)

17993 A MODEL FOR VV 8. Zipoy, D.M. (Astronomy Program, University of Maryland, College Park). Astrophys. J. 201: No. 2, 397-403 (15 Oct 1975).

We present new optical observations for the peculiar emission-line object VV 8 and investigate a fairly general model of the object. VV 8 probably is not a young planetary; instead, it is a shell star with a rather thick shell that produces the supergiant absorption spectrum characteristic of shell stars and in addition produces considerable reddening of the central star's spectrum. (auth)

17994 MASS TRANSFER IN THE SYMBIOTIC BINARY AG PEGASI. Hutchings, J.B.; Cowley, A.P.; Redman, R.O. (Dominion Astrophysical Observatory, Victoria, B.C., Canada). Astrophys. J. 201: No. 2, 404-412 (15 Oct 1975).

Line profiles, equivalent widths, and radial velocities have been derived from high-dispersion spectra of the symbiotic star AG Peg. The model suggested from recent spectra is a hot, approximately 1 $M_\odot$ subluminous star orbiting a 3–4 $M_\odot$ giant. The hot object rotates rapidly and ejects material which streams toward the cool primary. A bright region near the substellar point on the M star is responsible for a 0.3 mag light variation, and is heated either by radiation from the hot star or by collisions from the impinging stream. It is found that the size of the emission nebula surrounding the hot object has decreased, while its excitation has increased, since Merrill's observations several decades ago. At the same time, the stream density appears to have increased. An expanding, low-denisty envelope surrounds the system. The exact orbital period remains uncertain because of complications in the interpretation of the velocities from several regions, but a value of 820^d is adopted. The system is thought to be in a late stage of its evolution, but it is not clear what forces (perhaps magnetic?) drive the stream, since the stars are well separated. (auth)

17995 CRAB PULSAR OPTICAL AND X—RAY RADIATION THROUGH PINCHING INSTABILITIES. Benford, G. (Department of Physics, University of California, Irvine). Astrophys. J. 201: No. 2, 419-424 (15 Oct 1975).

Interpenetrating charged streams carrying no net current are unstable to formation of filaments of alternating positive and negative current. The electron-positron streams formed above the Crab pulsar gap become liable to this mode near the light cylinder distance from the pulsar surface, if they have differing average energies. We calculate the growth rate and nonlinearly saturated amplitude of the magnetic turbulence generated. Particles emit synchrotron radiation incoherently in this turbulence. Power spectrum, polarization, and luminosity agree with observations, and indicate that the optical X-ray and γ-ray spectra may stem from this same mechanism. (auth)

17996 THE RADIO SPECTRUM OF MICROPULSES FROM PULSAR PSR 0950+08. Rickett, B.J.; Hankins, T.H.; Cordes, J.M. (Department of Applied Physics and Information Science, University of California at San Diego). Astrophys. J. 201: No. 2, 425-430 (15 Oct 1975).

The microstructure in the radio pulses from PSR 0950+08 has been studied over both wide and narrow frequency ranges. The micropulses characterized by 0.17 ms duration are broad-band, exhibiting 50 percent correlation between 111 and 318 MHz. Over 125 kHz centered on 111 MHz the dynamic spectra of individual micropulses show deep modulation over intervals equal to the reciprocal of the pulse durations. These results are discussed in the light of the coherent radiation which is necessary to explain the large apparent brightness temperature seen in pulsars. We conclude that the micropulses result from the incoherent addition of many particle bunches, each one emitting coherently over a wide bandwidth. (auth)

17997 DOES A STEADY AXISYMMETRIC PULSAR MAGNETOSPHERE ACCELERATE CHARGES? Henriksen, R.N.; Norton, J.A. (Astronomy Group, Queen's University, Kingston, Ontario, Canada). Astrophys. J. 201: No. 2, 431-439 (15 Oct 1975).

The force-free axisymmetric pulsar magnetosphere is examined, including the inertial effects of a two-fluid plasma. Strictly speaking, only electrostatic acceleration is possible. This is not the case, however, for charged particles which are constrained to flow along rigidly corotating, force-free magnetic field lines. The integrals of the motion and the electromagnetic constraints together yield an algebraic set that describes completely this constrained particle acceleration. We find it as a function of boundary conditions at the surface of the star. This solution may emulate the inertial particle acceleration of the oblique rotator. "Inertial sling" solutions, yielding particles with high γ's and corotationally dominated motion, are possible only in magnetospheres for which the poloidal component of the magnetic field dominates sufficiently close to the light cylinder (unless the field is swept forward). The general theory is applied numerically and analytically to a two-fluid rotating monopole. Electrostatic acceleration is found not to be significantly responsible for particle acceleration in this case. (auth)

17998 A VARIATIONAL PRINCIPLE AND A STABILITY CRITERION FOR THE DIPOLE MODES OF PULSATION OF STELLAR MODELS IN GENERAL RELATIVITY. Detweiler, S.L. (University of Chicago). Astrophys. J. 201: No. 2, 440-446 (15 Oct 1975).

A variational principle is found for the frequencies of the dipole modes of pulsation of spherical stellar models in general relativity. This principle reveals that if the relativistic Schwarzschild discriminant, S, is not positive definite, then a stellar model is unstable to dipole perturbations. In addition, if S is positive definite the eigenfrequencies of all of the normal modes are real. (auth)

17999 ACCELERATION OF PULSARS BY ASYMMETRIC RADIATION. Harrison, E.R.; Tademaru, E. (Department of Physics and Astronomy, University of Massachusetts, Amherst, MA 00102). Astrophys. J. 201: No. 2, 447-461 (15 Oct 1975).

Examination of the observational data for 145 pulsars confirms previous conclusions that pulsars have velocities generally in excess of 100 km s^{-1}. Earlier theories on the origin of these high velocities are discussed and found to be not entirely satisfactory. A new theory is proposed in which it is suggested that pulsars, and perhaps all rotating stellar objects, have external magnetic fields resembling to a first approximation that of an oblique dipole moment displaced from the center of the star. Much of the evidence in support of an oblique off-centered dipole model comes from the interpulse pulsars and the observations of magnetic variable stars. A rotating dipole, off-centered from the spin axis, radiates asymmetrically in a direction parallel to the spin axis. The low-frequency luminosity L and the net radiation reaction force F are calculated, and the force is expressed in the form $F=\epsilon L/c$. It is shown that pulsars such as that in the Crab nebula are accelerated to velocities of several hundred kilometers per second when the radiation asymmetry coefficient ϵ has values in the range 10^{-1}–10^{-2}. The acceleration is rapid during a short period after the pulsar is born, and owing to the initial highly excited state of the pulsar it is possible that ϵ at this time is large and of order 0.1. The force is apparently sufficiently strong in most cases to remove a pulsar from a close binary system. In those cases where the radiation force and other disruptive effects are insufficient to destroy a binary state, it is shown that the force initially controls the evolution of the orbital parameters. (auth)

18000 THE MAXIMUM MASS OF NONROTATING NEUTRON STARS. Hegyi, D.J.; Lee, T.H. (Bartol Research Foundation of the Franklin Institute, Swarthmore, Pennsylvania); Cohen, J.M. Astrophys. J. 201: No. 2, 462-466 (15 Oct 1975).

We calculate the maximum mass of a nonrotating neutron star using only general relativity and making no assumptions about the equation of state of matter beyond the limitations of current nuclear physics. We find the upper mass limit of the neutron star to be about 8 $M_\odot$. By including other considerations, it may be possible to obtain even higher masses. (auth)

18001 NEUTRINO OPACITIES AT HIGH TEMPERATURES AND DENSITIES. Tubbs, D.L.; Schramm, D.N. (University of Chicago, Enrico Fermi Institute). Astrophys. J. 201: No. 2, 467-488 (15 Oct 1975).

A detailed calculation is made of the major cross sections contributing to neutrino opacities at high temperatures and densities such as those encountered in gravitational collapse. These calculations include the effects of neutral currents, where applicable, and electron degeneracy. The processes considered are electron-neutrino scattering (including both electron and muon neutrinos and antineutrinos), neutrino-nucleon absorption and scattering, and coherent neutrino scattering. Results for these interactions are also given for the average energy transferred by the neutrino as well as the mean scattering angle (thus yielding momentum transfer). (auth)

18002 THE MAGNETIC THERMAL WIND AND DIFFERENTIAL ROTATION OF IONIZED, MAGNETIC ATMOSPHERES. Gedzelman, S.D. (Department of Earth and Planetary Sciences, The City College of New York). Astrophys. J. 201: No. 2, 509-520 (15 Oct 1975).

Slow motions of an ideal, ionized, rotating fluid in the presence of a

nonconstant magnetic field are investigated. A magnetic analog to the thermal wind is found when the fluid is compressible. Vertical variations of the longitudinal fluid velocity are shown to result from a latitudinal gradient in magnetic field in such a manner that the angular velocity of the fluid decreases with height whenever the absolute value of non–force-free magnetic fields increases poleward. A second order contribution to this "magnetic thermal wind" is produced by vertical variations in the magnetic field. It is suggested that the magnetic thermal wind can have an important effect on the rotation rate of a stellar atmosphere and may be partially responsible for the apparent slow rotation rate of magnetic A type stars. (auth)

18003 STRONG SCINTILLATIONS IN ASTROPHYSICS. II. A THEORY OF TEMPORAL BROADENING OF PULSES. Lee, L.C.; Jokipii, J.R. (Department of Planetary Sciences, University of Arizona). Astrophys. J. 201: No. 2, 532-543 (15 Oct 1975).

We develop a theory of temporal broadening of pulses propagating in a turbulent medium, based on the Markov approximation discussed in Paper I. The theory may be applied to quite general turbulence spectra and to thin or thick turbulent regions. Since the basis of the theory is the wave equation, we do not rely on geometrical optics, nor do we make assumptions about the scattered angular spectrum. The observed smearing is found to be the combination of three effects which we term the dispersion effect, the pure refractive effect, and the diffraction effect. The last of these dominates for typical pulsar parameters. We explicitly calculate the pulse shapes for both Gaussian and Kolmogorov turbulence spectra and show how these scale with the various turbulence parameters. (auth)

18004 A DEEP SAMPLE OF NEW PULSARS AND THEIR SPATIAL EXTENT IN THE GALAXY. Hulse, R.A.; Taylor, J.H. (Department of Physics and Astronomy, University of Massachusetts, Amherst). Astrophys. J. Lett. 201: No. 2, L55-L59 (15 Oct 1975).

We present parameters for 40 pulsars discovered in a survey conducted at the Arecibo Observatory, and list the 10 previously known pulsars which were also detected. Of this total of 50 pulsars, 47 lie in the main search region $42° \lesssim l \lesssim 60°$, $|b| \lesssim 4°$. The survey reached a limiting average flux density of ~ 1 mJy, and appears to have detected a limit to the spatial distribution of pulsars in this direction, at a distance corresponding to DM=260 cm^{-3} pc. This limit is consistent with a markedly reduced density of pulsars at distances beyond 8–10 kpc from the galactic center. (auth)

18005 THE ANGULAR DIAMETER OF ALPHA HERCULIS A. Worden, S.P. (Kitt Peak National Observatory). Astrophys. J. Lett. 201: No. 2, L69-L70 (15 Oct 1975).

A digital analysis of speckle interferometry data for the M5 II supergiant α Her A produced for a uniformly illuminated disk diameters of 0".030 ± 0".001 at 5100 Å and 0".028 ± 0".003 at 5200 Å. These results are consistent with two of the three previous diameter determinations. (auth)

18006 THE CHEMICAL INHOMOGENEITY OF OMEGA CENTAURI. Freeman, K.C.; Rodgers, A.W. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, Australian National University). Astrophys. J. Lett. 201: No. 2, L71-L74 (15 Oct 1975).

Observations of 25 RR Lyrae stars in ω Cen have revealed a diversity in the composition of these stars. The composition spread explains the ill-defined giant branch and the existence of M stars in the cluster. The diversity may be due either to variable amounts of giant-branch mixing or to metal enrichment of protostellar gas during the cluster collapse. Among other considerations, the uniqueness of ω Cen leads us to prefer the latter hypothesis. (auth)

18007 ABUNDANCE VARIATIONS ON THE LOWER GIANT BRANCH OF OMEGA CENTAURI. Norris, J.; Bessell, M.S. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, Australian National University). Astrophys. J. Lett. 201: No. 2, L75-L79 (15 Oct 1975).

Photoelectric photometry on the *UBV*, *RI*, and DDO systems is presented for stars on the lower giant branch of ω Centauri. Analysis of these data leads to the following conclusions: (i) Differential reddening is small across the cluster ($\Delta E\,(B-V) \lesssim 0.04$). (ii) There exists a range of surface composition in the giants at the level of the horizontal branch which may be due either to abundance inhomogeneities within the cluster (which presumably existed at the end of the epoch of star formation) or to the mixing of processed materials from the interiors to the surfaces of these objects. Low-dispersion spectra (50 Å mm^{-1}) of some of these objects show relatively strong CN features indicating that the mixing hypothesis is probably the correct explanation. (auth)

18008 POSSIBLE IDENTIFICATION OF A CIRCUMSTELLAR 33-MICRON SILICATE EMISSION BAND IN COOL-STAR SPECTRA. Hagen, W.; Simon, T.; Dyck, H.M. (Institute for Astronomy, Honolulu). Astrophys. J. Lett. 201: No. 2, L81-L84 (15 Oct 1975).

Infrared photometry of S Per, μ Cep, and HD 11979 reveals that these stars have substantially larger flux excesses at 33 μ than do α Ori and *o* Cet. These prominent excesses may be attributable to a distinct lattice band in circumstellar dust grains composed of silicates such as γ-Ca_2SiO_4, Fe_2SiO_4, or Mn_2SiO_4. The observations show that the abundance of this silicate material varies dramatically from one star to another among the class of M stars. (auth)

18009 A PRELIMINARY STUDY OF THE MAIN-SEQUENCE LUMINOSITY FUNCTION OF THE GLOBULAR CLUSTER M92. van den Bergh, S. (David Dunlap Observatory, University of Toronto). Astrophys. J. 201: No. 3, 585-588 (1 Nov 1975).

The Hale 5-m telescope has been used to study the luminosity function of M92 down to $V \gtrsim 23.25$. The main-sequence luminosity function is found to rise very steeply from $M_V = +4$ to $M_V = +6$. Between $M_v = +6$ and $M_V = +8$ the luminosity function appears to remain essentially constant. (auth)

18010 MASS FLOW IN THE 07f BINARY UW CANIS MAJORIS. McCluskey, G.E. Jr. (Division of Astronomy, Department of Mathematics, Lehigh University, Bethlehem, Pennsylvania); Kondo, Y.; Morton, D.C. Astrophys. J. 201: No. 3, 607-612 (1 Nov 1975).

The ultraviolet spectrum of the eclipsing binary UW CMa (07f+O–B) has been observed by the Princeton telescope spectrometer on the *Copernicus* satellite in the wavelength region from about 950–1560 Å at a resolution corresponding to 0.2 Å. A number of stellar and interstellar lines appear in the spectrum. The following lines showing P Cygni characteristics have been observed: C III (977, 1175 Å), S IV (1062, 1072 Å), P V (1117 Å), Fe III + Si IV? (1122 Å), P V + S IV? (1128 Å), N V (1238, 1242 Å), Si IV (1393, 1402 Å), and C IV (1549 Å). The centers of the absorption components of the P Cygni lines yield radial velocities of from −200 to −800 km s^{-1}, while the peaks of the emission components are shifted by +400 to +800 km s^{-1}. These velocities are significantly larger than the projected orbital velocity of about 200 km s^{-1}, and indicate that gas motions in the system are occurring. A mass-loss rate of about 3×10^{-6} solar masses per year is estimated. A few photospheric absorption lines from the O7f component are also present: N III (1006), 1183, 1184 Å) and possibly He II (1084 Å). A discussion of the evolution of this system, based on the current observations as well as earlier ground-based spectroscopic and photometric investigations, is given. (auth)

18011 LOW-RESOLUTION ULTRAVIOLET SPECTROSCOPY OF SEVERAL HOT STARS OBSERVED FROM *APOLLO* 17. Henry, R.C.; Weinstein, A.; Feldman, P.D.; Fastie, W.G.; Moos, H.W. (Department of Physics, The Johns Hopkins University). Astrophys. J. 201: No. 3, 613-623 (1 Nov 1975).

Low-resolution ultraviolet spectra were obtained for six early-type stars in 1972 December, using an Ebert spectrometer mounted in the service module of the *Apollo* 17 spacecraft. The spectrometer scanned from 1180 Å to 1680 Å, with a speed that varied with wavelength according to a program chosen for lunar studies. Spectral resolution was 11 Å. The ultraviolet absolute calibration of the instrument was determined by comparison with National Bureau of Standards calibrated photodiodes, and is believed known to ±10 percent. Stars observed, with their spectral classes, were ξ Oph (O9.5), α Vir (B1 V), ξ Tau (B2 IV), η UMa (B3 V), α Eri (B5 IV), and α Gru B5 V). The absolute intensities are in good general agreement with the observations of others, and with the predictions of stellar model-atmosphere calculations. (auth)

18012 A SEARCH FOR STRONG MAGNETIC FIELDS IN RAPIDLY ROTATING Ap STARS. Landstreet, J.D. (Department of Astronomy, University of Western Ontario); Borra, E.F.; Angel, J.R.P.; Illing, R.M.E. Astrophys. J. 201: No. 3, 624-629 (1 Nov 1975).

A search for strong magnetic fields ($\gtrsim 10^3$ gauss) in rapidly rotating peculiar A stars has been made using the solar magnetograph technique on Balmer lines. Observations of 16 stars have been made with standard errors typically in the range of 300 to 700 gauss. No definite fields are found, and the results indicate that fields in excess of 10^3 gauss are significantly less common among rapidly rotating Ap stars than among slowly rotating ones. (auth)

18013 POLARIZED LIGHT FROM LOWER MAIN-SEQUENCE STARS: IS IT DUE TO SYNCHROTRON EMISSION? Mullan, D.J. (Bartol Research Foundation of the Franklin Institute, Swarthmore, Pennsylvania). Astrophys. J. 201: No. 3, 630-636 (1 Nov 1975).

Broad-band plane polarization (0.1–10%) has been observed in the light emitted by flare stars outside flares. Here we examine the possibility that the polarization might be due to synchrotron radiation. On the basis of the electron energy spectrum which would be required, we suggest that synchrotron radiation is probably not resposible for the observed polarization. (auth)

18014 CONVECTIVE OVERSHOOTING IN MAIN-SEQUENCE MODELS. Cogan, B.C. (Mount Stromlo and Siding Spring Observatory, Research School of Physical Sciences, Australian National University). Astrophys. J. 201: No. 3, 637-640 (1 Nov 1975).

A simplified treatment of convective overshooting which includes the flux carried by the overshooting elements is presented. It is applied to a $3\,M_\odot$ model and predicts the extent of overshooting to be 0.23 pressure scale heights. This distance is determined by three factors: the convective velocity and efficiency and the gradient of the radiative temperature gradient. Sample calculations indicate that in most main-sequence stars the fractional mass added to the convective core is approximately the same. Finally it is concluded that uncertainties in convection theory make it impossible to assign definitive values to the overshooting distance. (auth)

18015 HYDRODYNAMIC MODELS OF A CEPHEID ATMOSPHERE. III. LINE SPECTRUM AND RADIUS DETERMINATIONS. Karp, A.H. (Astronomy Program, University of Maryland). Astrophys. J. 201: No. 3, 641-652 (1 Nov 1975).

The hydrodynamic models of Karp have been used to study line profiles in a moving atmosphere. First, it is shown that the velocity gradients in the atmosphere of the hydrodynamic model are not large enough to account for either the observed microturbulence or the variation of microturbulence with phase. It is then shown that, while the asymmetry of weak lines may be due to geometric distortion, the asymmetry of the strong lines is probably due to velocity gradients in the line-forming region. The occurrence of split line cores is then studied, and it is shown that they may be formed by a temperature inversion in the atmosphere. The line profiles are used to generate velocity curves which indicate that the assumptions inherent in the Wesselink method for determining radii of pulsating stars do not introduce large errors. These velocity curves are combined with the light and color curves of Karp to investigate the accuracy of the Wesselink method. It is shown that, while 10 percent accuracy is possible, the errors will probably be 15 percent to 20 percent. This result implies that the empirical period-radius relation cannot be used to detect overtone pulsators as suggested by Fernie. (auth)

18016 THE NATURE OF DWARF CEPHEIDS. I. AD CANIS MINORIS. Breger, M. (University of Texas at Austin and McDonald Observatory). Astrophys. J. 201: No. 3, 653-660 (1 Nov 1975).

New $uvby\beta$ photometry of AD CMi covering several cycles is reported. No evidence for shock wave emission is detected in either the $H\beta$ line or in the Wesselink radius solutions. Due to the large acceleration at certain phases, a Wesselink analysis requires phases at equal temperatures, as opposed to phases of equal color. This explains the previously reported failure of the Wesselink method as well as the reported evidence for shock waves. The observed ultraviolet excess during the rising branch can be fully explained by effective gravity variations. A Wesselink radius of $3\,R_\odot$ is derived. This leads to a Population I mass. No evidence for a low-mass Population II nature exists for this star. Except for the large amplitude, the star is virtually indistinguishable from a normal δ Scuti variable. (auth)

18017 GAS FLOW IN CATACLYSMIC VARIABLE STARS. Flannery, B.P. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz). Astrophys. J. 201: No. 3, 661-694 (1 Nov 1975).

A numerical hydrodynamic scheme, applicable to gas flow in binary stars, is presented which incorporates the effects of pressure and gravitational forces, radiative cooling, and shock formation. The method is used to study gas flow originating from Roche lobe overflow through the inner Lagrangian point, L_1, in a binary star modeled to resemble the dwarf nova Z Cam. Three mass transfer rates, $3\times$ (10^{-9}, 10^{-8}, 10^{-7}) $M_\odot$ year^{-1}, are followed for a total time of 1.50 binary orbital periods. The calculations indicate that rapid energy dissipation, via radiative cooling in a shock front formed between the stream from L_1 and the returning gas which has circuited the star, quickly transforms the flow into a stream-ring configuration. An optically thick, confined shock forms at the intersection of the stream and ring. At a transfer rate of $3\times10^{-9}\,M_\odot$ year^{-1} the shock's location, temperature (23,000 K at maximum), and energy release (8×10^{32} ergs s^{-1}) are in substantial agreement with observations of Z Cam, and confirm the major elements of the "hot spot" model proposed to account for observations of cataclysmic variable stars. (auth)

18018 CARBON DETONATIONS IN RAPIDLY ROTATING STELLAR CORES. Mahaffy, J.H.; Hansen, C.J. (Joint Institute for Laboratory Astrophysics, University of Colorado and National Bureau of Standards). Astrophys. J. 201: No. 3, 695-704 (1 Nov 1975).

Equilibrium models have been constructed for rapidly differentially rotating isothermal stellar cores with central densities ranging from 2×10^9 to 10^{10} g cm^{-3}. The composition, of equal parts by mass of ^{12}C and ^{16}O, is taken to represent that of a pre-carbon-detonation supernova. It is noted that the absolute values of the total energies of these cores is always less than the nuclear energy available from processing up to iron peak nuclei. Detonations are initiated in the center of some of these models, and the subsequent dynamics are followed with an axisymmetric, two-dimensional Eulerian hydrodynamic code. It is found that the presence of rotation does not lower the central density required for leaving a bound remnant down to the density range at which current evolutionary calculations predict the explosive ignition of carbon. Hence, the results of standard spherically symmetric calculations are not altered in that 4–8 $M_\odot$ stars are totally disrupted after carbon ignition. (auth)

18019 OBLIQUE ROTATING PULSAR MAGNETOSPHERES WITH WAVE ZONES. Henriksen, R.N.; Norton, J.A. (Astronomy Group, Queen's University, Kingston, Ontario). Astrophys. J. 201: No. 3, 719-728 (1 Nov 1975).

The equations for the oblique force-free pulsar magnetosphere are formulated and solved in the linear case. The total solution is a superposition of fundamental modes, subject to boundary conditions at the star. The eigensolutions are wavelike in the far zone. For a perpendicular oblique rotator, the resulting limiting polar field structure near the light cylinder is cusplike, providing a possible efficient emission zone. The integral of motion for charged particles constrained to move on the field line structure determined in the massless approximation, is developed in a complete but simple manner. We find that high energies may be achieved by particles moving on sufficiently radial or forward swept field lines in the near zone, as well as in the wave zone. (auth)

18020 A NEW METHOD FOR DETERMINING DOPPLER WIDTHS. Steinitz, R.; Bar, V. (Department of Physics and Astronomy, Tel-Aviv University); Wyckoff, S. Astrophys. J. 201: No. 3, 729-734 (1 Nov 1975).

An explicit analytical relation between the absorption-line profile and the emergent intensity is developed for a stellar atmosphere in which the absorption profile and the source and sink terms of the source function are depth-independent. Using this relation, a method is described for determining the Doppler width of the solar chromospheric $H\alpha$ absorption profile, for which it is known that the source and sink terms are indirectly controlled by radiation fields external to the line-forming zone. Good agreement is found between the Doppler width derived for solar $H\alpha$ and previous results. Finally, the method for determining the Doppler width is generalized for application to stellar spectra. (auth)

18021 RANDOM GRAVITATIONAL ENCOUNTERS AND THE EVOLUTION OF SPHERICAL SYSTEMS. VII. SYSTEMS WITH SEVERAL MASS GROUPS. Spitzer, L. Jr.; Shull, J.M. (Princeton University Observatory). Astrophys. J. 201: No. 3, 773-782 (1 Nov 1975).

Monte Carlo computations for model clusters have given quantitative information on the dynamical evolution of systems in which stars of three different mass groups are present, with masses in the ratios 1:2.5:6.25. The seven systems analyzed all show pronounced mass stratification developing in a time of 1 to 2 times t_{rh}, the reference relaxation time. The initial escape rate for the two lighter mass groups is about the same as for the one-component systems previously analyzed, but increases with time by factors of 2 to 5 as the lighter stars move outward because of mass fractionation. The escape rate for the more massive stars tends to be less than for the lighter stars, especially at the later times. The core of the cluster contracts initially because of mass stratification but ends up by collapsing in much the same way as do the cores of one-component system, with the square of the radius containing 2 percent of the mass decreasing linearly with time, extrapolating to 0 when t/t_{rh} is between 3 and 6. Both analytical theory and special Monte Carlo runs verify that the tendency toward equipartition does not play the dominant part in the late collapse of these three-component systems. During the life of the clusters before collapse, at most three-fourths of the lighter stars escape, if the maximum shock heating experienced by present clusters is assumed. Comparison of actual globular clusters with the present model suggests that the observed heavier stars, each of mass about $0.7\,M_\odot$, may be embedded in a more massive, more extended system of very faint lighter stars. Alternatively, the less massive stars may mostly have escaped during earlier stages, not covered by the present models. (auth)

18022 MAGNETOSPHERES AND PULSARS WITH NET CHARGE. Cohen, J.M.; Kegeles, L.S. (Department of Physics, University of Pennsylvania); Rosenblum, A. Astrophys. J. 201: No. 3, 783-791 (1 Nov 1975).

It is shown that a pulsar surrounded by a corotating magnetosphere region can possess a net charge. If there is no streaming, the star must be charged. The result is shown for the special-relativistic case as well as for the fully general-relativistic model, including the effects of strong gravitation and the dragging of inertial frames. The value of the charge is of the order of 10^{12} coulombs and depends upon the angle between the rotation and magnetic dipole axes. In the special-relativistic case, the dipole magnetosphere contains no net charge, whereas when general relativity is included, the magnetosphere possesses net charge which can be comparable to that of the star itself. This is a new general-relativistic effect. Because of their net charge, pulsars possessing this type of corotating magnetosphere region are sources of charged particles. (auth)

18023 BINARY SYSTEMS IN STAR CLUSTERS. II HD 162724. Leung, K. (Behlen Observatory and Behlen Laboratory of Physics, University of Nebraska); Schneider, D.P. Astrophys. J. 201: No. 3, 792-798 (1 Nov 1975).

Over 2000 photoelectric observations of HD 162724 in the yellow, blue, and ultraviolet were analyzed. The period found was 2.786847 days. The depths of primary and secondary minima were about equal. A photometric solution was derived with the Wilson and Devinney model. The binary is found to be a detached system with a mass ratio of 0.88. Both components are at the end of the hydrogen-burning phase of evolution. (auth)

18024 SEMIEMPIRICAL UPPER PHOTOSPHERE MODELS: THE SUN (G2 V) AND PROCYON (F5 IV–V). Ayres, T.R. (Joint Institute for Laboratory Astrophysics, University of Colorado). Astrophys. J. 201: No. 3, 799-815 (1 Nov 1975).

We describe a general method for inferring the average upper photosphere temperature structure of a late-type star using calibrated observations of resonance line wings and a partial coherent scattering approximation. We apply this approach to two problems: (1) We make a comparison of the excess radiative losses from the upper photospheres of the Sun and Procyon by "calibrating" observed profiles of the Ca II K line wings relative to Kurucz's radiative equilibrium models for $\tau_{5000} \gtrsim 0.1$. We interpret deviations of the empirical fluxes from the synthesized profiles as evidence for departures from radiative equilibrium in the surface layers of both stars ($\tau_{5000} < 0.1$). We construct temperature enhancement models to account for these deviations, and estimate rough upper limits to the corresponding excess radiative losses by considering only the effect of the Planck function differences on the H^- radiative loss rate. (2) We obtain an accurate determination of the Mg II k to Ca II K emission core flux ratio for the Sun and Procyon by calibrating the Mg II k wings relative to the Ca II K wings in each star. Our results support Ulmschneider's speculation that short-period acoustic waves heat the lower chromosphere after being heavily damped in the upper photosphere. In addition, we find that Procyon's chromospheric temperature gradient is probably shallower than the Sun's, although the acoustic energy dissipation in Procyon's upper photosphere is very likely larger, in accord with de Loore's application of the Lighthill-Proudman theory. (auth)

18025 INTERPRETATION OF THE PULSED GAMMA-RAY EMISSION FROM VELA. Thompson, D.J. (NASA/Goddard Space Flight Center, Greenbelt, Maryland). Astrophys. J. Lett. 201: No. 3, L117-L120 (1 Nov 1975).

A model is proposed for the Vela pulsar in which the radio emission originates near the surface of the neutron star while the pulsed γ-ray emission is produced by synchrotron radiation near the speed-of-light cylinder. This model can explain the energy flux, double pulse structure, and phase shift (with respect to the radio) of the γ-ray emission, and offers approximate quantitative predictions for other X- and γ-ray fluxes. (auth)

18026 VARIABLE STARS IN THE X—RAY GLOBULAR CLUSTER NGC 1851. Liller, M.H. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory). Astrophys. J. Lett. 201: No. 3, L125-L126 (1 Nov 1975).

Ten known and four new variable stars in the X-ray globular cluster NGC 1851 have been studied. None of these variables show obvious unusual characteristics that would make them candidates for the X-ray emission. The characteristics of the variable stars are presented. (auth)

18027 OBSERVATIONS OF THE CIRCUMSTELLAR GAS SHELLS AROUND BETELGEUSE AND ANTARES. Bernat, A.P.; Lambert, D.L. (McDonald Observatory and Department of Astronomy, University of Texas). Astrophys. J. Lett. 201: No. 3, L153-L156 (1 Nov 1975).

K I resonance line (λ7699) emission has been detected from the circumstellar gas shell surrounding Betelgeuse (α Ori). A shell diameter of 4″–8″ (80–160 stellar radii) is indicated. New observations of the Ca II infrared triplet line cores are used to obtain a lower limit to the Ca^+ (and, hence, K I) shell radius. The 8542 Å line in α Ori does not show a circumstellar absorption core, and the shell radius limit, $R_{shell} \geq 31\ R_{star}$, is estimated. A 108 mÅ circumstellar core is seen in the 8542 Å line in Antares (α Sco), and a shell radius $R_{shell} \simeq 4.0\ R_{star}$ is suggested. (auth)

18028 RADIAL VELOCITIES OF STARS WITH MICROWAVE MASER EMISSION. I. LONG-PERIOD VARIABLES. Wallerstein, G. (Astronomy Department, University of Washington, Seattle). Astrophys. J. Suppl. Ser. 29: No. 291, 375-396 (Sept 1975).

Extensive radial-velocity measurements of high-dispersion optical spectra ($\lambda\lambda$3500–9000) of long-period variables are presented and analyzed so as to establish the photospheric, emission, and circumstellar velocities. The data are compared with microwave emission velocities from the molecules OH, H_2O, and SiO. Correlations among the various velocities are presented and discussed. Usually at least one microwave component has the same velocity as the stellar photosphere, and frequently one or more microwave velocities agree with the velocity of the circumstellar envelope. Other microwave components frequently fall between the photospheric and circumstellar velocities. The question of whether the absorption or emission lines represent the true stellar velocity is carefully discussed. The correlations among the microwave and stellar absorption velocities favor the absorption velocity as representative of the center of mass. However, the possibility remains that the velocities of the permitted and forbidden lines represent the stellar velocity, provided that the emission lines are formed at small optical depth and hence are strongly limb-brightened. (auth)

18029 THE MASS OF THE GALACTIC HALO DERIVED FROM THE LUMINOSITY FUNCTION HIGH-VELOCITY STARS. Schmidt, M. (Hale Observatories, California Institute of Technology, Carnegie Institution of Washington). Astrophys. J. 202: No. 1, 22-29 (15 Nov 1975).

The local luminosity function of high-velocity stars is derived on the basis of a complete sample of stars of large proper motion with trigonometric parallaxes. The fraction of these stars belonging to a roughly spherical galactic halo is deduced by using a kinematical criterion based on space velocities of metal-poor RR Lyrae variables. The local mass density of halo stars is about 1.7×10^{-4} solar masses per cubic parsec, corresponding to a fractional mass within the Sun's distance from the center of 6 percent, i.e., an order of magnitude lower than that of the massive halo proposed by Ostriker and Peebles. (auth)

18030 H_2O SOURCES IN REGIONS OF STAR FORMATION. Lo, K.Y.; Burke, B.F.; Haschick, A.D. (Department of Physics, Research Laboratory of Electronics, Massachusetts Institute of Technology). Astrophys. J. 202: No. 1, 81-91 (15 Nov 1975).

Regions and objects believed to be in early stages of stellar formation have been searched for H_2O 22-GHz line emission with the Haystack 120-foot (37 m) telescope. The objects include radio condensations, infrared objects in H II regions, and Herbig-Haro objects. Nine new H_2O sources were detected in the vicinity of such objects, including the Sharpless H II regions S152, S235, S255, S269, G45.1 + 0.1, G45.5+0.1, AFCRL infrared object No. 809–2992, and Herbig-Haro objects 1 and 9. The new H_2O sources detected in H II regions are associated, but not coincident, with the radio condensations. Water vapor line emission was detected in ~25 percent of the regions searched. The association of H_2O sources with regions of star formation is taken to be real. The spatial relationship of H_2O sources to infrared objects, radio condensations, class I OH sources, and molecular clouds are discussed. The suggestion is made that an H_2O source may be excited by a highly obscured star of extreme youth. (auth)

18031 THEORY OF EXTENDED STELLAR ATMOSPHERES. II. A GRID OF STATIC SPHERICAL MODELS FOR O STARS AND PLANETARY NEBULA NUCLEI. Kunasz, P.B.; Hummer, D.G. (Joint Institute for Laboratory Astrophysics, National Bureau of Standards and University of Colorado); Mihalas, D. Astrophys. J. 202: No. 1, 92-113 (15 Nov 1975).

Spherical static non-LTE model atmospheres are presented for stars with $M/M_\odot = 30$ and 60 at various points on their evolutionary tracks, and for some nuclei of planetary nebulae at two points of a modified Harman-Seaton sequence. The method of Mihalas and Hummer was employed, which uses a parametrized radiation force multiplier to simulate the force of radiation arising from the entire line spectrum. However, in the present work the density structure computed in the LTE models was held fixed in the calculation of the corresponding non-LTE models; in addition, the opacity of an "average light ion" was taken into account. The effects of sphericity, as distinct from those arising from a density structure modified by a large radiation force, were investigated by computing a few planar models using the same parametrized radiation force multiplier as for the spherical models. These effects were found to be quite significant even though the atmospheric extension never becomes very large. The temperatures for the non-LTE models are generally lower, at a given depth, than for the corresponding LTE models when $T_{eff} < 45{,}000$ K, while the situation is reversed at higher temperatures. The continuous energy distributions are generally flattened by extension. The Lyman jump is in emission for extended models of massive stars, but never for the models of nuclei of planetary nebulae (this is primarily a temperature effect). The Balmer jumps are always in absorption. The Lyman lines are in emission, and the Balmer lines in absorption; He II λ4686 comes into emission in the most extended models without hydrogen line pumping, showing that it is an indicator of atmospheric extension. Very severe limb darkening is found for extended models, which have apparent angular sizes significantly smaller than expected from the geometrical size of the star. Extensive tables are given of monochromatic magnitudes, continuum jumps and gradients, Stömgren-system colors, monochromatic extensions, and the profiles and equivalent widths of the hydrogen lines for all models, and of the He II lines for some of the $60\ M_\odot$ models. (auth)

18032 THE LOSS OF ANGULAR MOMENTUM AND THE EVOLUTION OF Ap-TYPE STARS. Wolff, S.C. (Institute for Astronomy, University of Hawaii). Astrophys. J. 202: No. 1, 121-126 (15 Nov 1975).

There is a correlation between the radius and period for Ap stars, in the sense that stars of longer period have larger radii. This result is to be expected if the more slowly rotating Ap stars have evolved farther away from the zero-age main sequence than Ap stars with more rapid

rotation. It is shown that the period-frequency distribution of the non-Si Ap stars, the correlation of radius with period, and the absence of Si stars with periods longer than 20 days can all be accounted for if the time required for magnetic deceleration to reduce rotational velocities to values less than 10 km s^{-1} is on the order of a few times 10^8 years. (auth)

18033 THE DISTRIBUTION OF PERIODS OF THE MAGNETIC A-TYPE STARS. Wolff, S.C. (Institute for Astronomy, University of Hawaii). Astrophys. J. 202: No. 1, 127-136 (15 Nov 1975).

Four-color (*uvby*) photoelectric observations are used to obtain periods for several Ap stars with $v \sin i < 10$ km s^{-1}. The derived periods are 69.0 days for HD 5797, 10.61 days for HD 22374, 69 days for HR 3724, and 5.07 days for HD 115708. The magnetic field strengths measured from Zeeman spectrograms of 33 Lib vary with a period of 23.26 days. Photoelectric and Zeeman spectroscopic observations yield a period of 525 days for HD 2453. Evidence is given that suggests that HR 4816 may vary on a time scale of 10 years. The present observations, combined with results published previously, make it possible to derive the distribution of periods for the cool (non-Si) Ap-type stars. It is argued that the data support the hypothesis that the period of variation is to be identified in all cases with the period of rotation, and that the existence of Ap stars with extemely long periods is due to the loss of angular momentum through some form of magnetic braking. (auth)

18034 VIBRATIONAL STABILITY OF DIFFERENTIALLY ROTATING STARS. Aizenman, M.L.; Cox, J.P. (Joint Institute for Laboratory Astrophysics, University of Colorado and National Bureau of Standards). Astrophys. J. 202: No. 1, 137-147 (15 Nov 1975).

We have obtained the formal solution, in linear, nonadiabatic theory, of the problem of the vibrational stability of a system possessing arbitrary, but steady, inviscid flows in its unperturbed (nonoscillating) state. The unperturbed system may have any geometry, but no large-scale magnetic fields are assumed. A special case is a (steadily) rotating star, where the rotation may be uniform or differential, slow or fast. This formulation may ultimately provide a new approach to the problem of the interaction (in linear theory) between stellar convection and pulsations. The formal solution is expressed in terms of certain integrals over the volume of the system. These integrals involve the nonadiabatic eigenfunctions for the oscillating system, but they may be approximated by suitable trial functions. This solution is surprisingly simple, bears considerable resemblance to previously derived formal solutions, and has a straightforward physical interpretation. (auth)

18035 ATMOSPHERIC TURBULENCE MEASURED IN STARS ABOVE THE MAIN SEQUENCE. Gray, D.F. (Department of Astronomy, University of Western Ontario). Astrophys. J. 202: No. 1, 148-164 (15 Nov 1975).

Measurements of broadened line profiles are analyzed to identify, measure, and separate macroturbulence from rotation. Evidence is presented for the possibility of more than one macroturbulence velocity distribution. (auth)

18036 ULTRAVIOLET OBSERVATIONS OF COOL STARS. III. CHROMOSPHERIC AND CORONAL LINES IN α TAURI, β GEMINORUM, AND α BOOTIS. McClintock, W. (Department of Physics, The Johns Hopkins University); Linsky, J.L.; Henry, R.C.; Moos, H.W.; Gerola, H. Astrophys. J. 202: No. 1, 165-182 (15 Nov 1975).

The ultraviolet spectrometer of the Princeton Experiment Package aboard the *Copernicus* satellite has been used to obtain high-resolution measurements of Lα, the Mg II λ2800 doublet, and upper limits on the Si III λ1206 line in the K giants α Tau and β Gem. The intensities and line shapes are compared with earlier observations of α Boo. The Lα and Mg II profiles for α Tau resemble those for α Boo, in that they are highly asymmetrical, while β Gem shows much more symmetrical profiles. The asymmetries for all lines except for those of α Boo and Mg II lines of α Tau could be due to interstellar absorption. In the case of β Gem only, the O V intercombination line at 1218 A is observed, suggesting a well-developed corona substantially cooler than that of the Sun. The Lα profiles of α Tau and β Gem are consistent with the low interstellar hydrogen abundance in the solar neighborhood previously obtained from a similar observation of the α Boo Lα profile. The strength of the Mg II λ2796 line can be used to measure transition region and coronal pressures, and indicates a decrease in both with later spectral type and/or increasing luminosity. (auth)

18037 MASS LOSS FROM THE INFRARED STAR CIT 6. Mufson, S.L.; Liszt, H.S. (National Radio Astronomy Observatory, Green Bank, West Virginia). Astrophys. J. 202: No. 1, 183-190 (15 Nov 1975).

We have observed 2.6 mm carbon monoxide emission from a small (~20′) region surrounding CIT 6. The line profiles are doubly peaked, and we have interpreted them as arising from a disk which is rotationally ejected from the outer layers of the stellar atmosphere. The mathematics of rotationally forced ejection are presented. (auth)

18038 SPECTRA OF WHITE DWARFS. Wickramasinghe, D.T.; Hintzen, P.; Strittmatter, P.A. (Steward Observatory, University of Arizona); Burbidge, E.M. Astrophys. J. 202: No. 1, 191-194 (15 Nov 1975).

Results of a spectroscopic survey of white dwarf candidates from the Lowell Observatory lists are reported. *UBV* photometry is shown to be effective in enhancing the detection rate of DB white dwarfs. The spectrum of GD 40 contains lines of Ca II H and K in addition to those of He I; it is the first DB to show lines of any element other than helium. (auth)

18039 *p*-PROCESS NUCLEOSYNTHESIS IN POSTSHOCK SUPERNOVA ENVELOPE ENVIRONMENTS. Audouze, J. (California Institute of Technology); Truran, J.W. Astrophys. J. 202: No. 1, 204-213 (15 Nov 1975).

Nuclear transformations giving rise to the production of the *p*-process (bypassed) elements are examined within the framework established by explosive nucleosynthesis studies. The guiding assumption is that thermonuclear processes occurring in hydrogen-rich matter in supernova envelopes following the passage of a shock wave are responsible for the formation of these nuclei. It is demonstrated that there exists a restrictive range of temperature-density conditions ($T \sim 2 \times 10^9$ K; $\rho \sim 10^4$ g cm^{-3}) for which the enhanced production of most of the *p*-process nuclei occurs in relative concentrations consistent with solar system abundances. The implications of these results for galactic nucleosynthesis are discussed. (auth)

18040 THE *r*-PROCESS PRODUCTION RATIOS OF LONG-LIVED RADIONUCLIDES. Johns, O. (Lawrence Berkeley Laboratory, Berkeley, California); Reeves, H. Astrophys. J. 202: No. 1, 214-221 (15 Nov 1975).

The *r*-process production ratios of ^{232}Th, ^{235}U, ^{238}U, and ^{244}Pu, and their uncertainties, are estimated without dependence on specific *r*-process models. The estimates are based on similarities between nuclei of the same nuclear type in the rare-earth and actinide regions. All actinide alpha-series progenitors are assumed to be equally produced, and the uncertainties in this estimate are derived from the rms fluctuations of observed rare-earth even-even isotopic abundances about their mean. It is shown, however, that the systematic odd-even effect in rare-earth abundances cannot be applied reliably to the actinide region. Production ratios involving ^{235}U are thus more uncertain than ratios between two even nuclides. The estimated production ratios and uncertainties are compared with previously published ones. (auth)

18041 ON THE PRODUCTION OF LITHIUM, BERYLLIUM, AND BORON AT LOW ENERGIES. Bodansky, D.; Jacobs, W.W.; Oberg, D.L. (Department of Physics, University of Washington, Seattle). Astrophys. J. 202: No. 1, 222-231 (15 Nov 1975).

Relative yields of LiBeB isotopes are calculated for proton and α-particle induced reactions at energies in the neighborhood of 10 or tens of MeV, and comparisons are made with solar system abundances. A match is found for incident particles in the neighborhood of 16 MeV, assuming the meteoritic value of the B abundance and standard values for other target and product abundances. To obtain matches to a lower than meteoritic B abundance or for protons and α-particles at the same energy per nucleon, it is found necessary to alter the initial abundance assumptions or assume selective destruction. The range of possible fits suggests that the nuclear cross sections do not preclude each of the LiBeB isotopes being produced mainly in reactions at the relatively low energies considered here. (auth)

18042 ELECTRICAL CONDUCTIVITY AND MAGNETIC FIELD DECAY IN NEUTRON STARS. Ewart, G.M.; Guyer, R.A. (University of Massachusetts, Amherst); Greenstein, G. Astrophys. J. 202: No. 1, 238-247 (15 Nov 1975).

We evaluate the contributions to the electrical resistivity of neutron star crusts due to phonon scattering at high and low temperatures, due to scattering from charge disorders, and due to scattering from dislocations. Our results indicate that decay of pulsar magnetic fields can take place only if (*a*) they are significantly hotter than cooling theory predicts, (*b*) their crusts are exceedingly impure, or (*c*) their crusts are made up of an exceedingly fine mosaic of crystallites. (auth)

18043 ANISOTROPIC GRAVITY AND THE BINARY PULSAR PSR 1913+16. Nordtvedt, K. Jr. (Montana State University). Astrophys. J. 202: No. 1, 248-249 (15 Nov 1975).

If anisotropic post-Newtonian metric potentials exist, celestial bodies will possess anisotropic inertial and/or gravitational masses. The binary pulsar system PSR 1913+16 puts stringent limits on such anisotropies through its observable perihelion precession rate and hence offers a Hughes-Drever-type experiment for massive celestial bodies. (auth)

18044 A SENSITIVE SEARCH FOR SOFT X—RAYS FROM ARCTURUS AND PROCYON. Cruddace, R.; Bowyer, S.; Malina, R.; Margon, B.; Lampton, M. (Space Sciences Laboratory, University of California, Berkeley). Astrophys. J. Lett. 202: No. 1, L9-L12 (15 Nov 1975).

Sensitive soft X-ray observations have been obtained of α Boo and α CMi using rocket-borne large area proportional counters. No flux was

detected from either star, yielding limits on intrinsic luminosity in the 75–2000 eV band (6–165 Å) as stringent as 10^{28} ergs s^{-1} depending upon assumed coronal temperature. These are at least an order of magnitude better limits than previously reported values. Upper limits are also set on a mass loss rate of 3×10^{-9} $M_\odot$ yr^{-1} and on an emission measure of less than 3×10^{53} cm^{-3}. If these stars are typical, then giants and subgiants cannot be responsible for a significant fraction of the soft component of the diffuse X-ray background. (auth)

18045 OPTICAL STUDIES OF *UHURU* SOURCES. XIII. A PHOTOMETRIC ANALYSIS OF X PERSEI (=3U 0352+30?). Gottlieb, E.W.; Wright, E.L.; Liller, W. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory). Astrophys. J. Lett. 202: No. 1, L13-L14 (15 Nov 1975).

2677 magnitudes of the hot massive variable star X Persei, the prime optical candidate for the X-ray source 3U 0352+30, have been obtained from blue plates in the Harvard collection taken between 1894.9 and 1975.1. We have analyzed these data for periods from 0.5 to 180 days and find no periodic component of brightness with full sinusoidal amplitude ≥ 0.05 mag. Other period searches, from 550 to 618 days and from 10.75 to 11.75 hours, likewise gave negative results for full amplitudes of ≥ 0.07 mag. We publish the mean light curve and comment on its properties. (auth)

18046 INITIAL RESULTS OF SPATIAL INTERFEROMETRY AT 5 MICRONS. McCarthy, D.W.; Low, F.J. (Lunar and Planetary Laboratory and Steward Observatory, University of Arizona). Astrophys. J. Lett. 202: No. 1, L37-L40 (15 Nov 1975).

A new type of infrared spatial interferometer has been developed to measure the angular sizes and shapes of circumstellar dust shells. At a wavelength of 5 μ the diameter of VY CMa is approximately 0".45. The size and structure of IRC+10216 are consistent with previous lunar occultation results. Upper limits are placed on the angular diameters of nine other stars. (auth)

18047 THE CORONAL LINE SPECTRUM OF AS 295. Herbig, G.H. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz); Hoffleit, D. Astrophys. J. Lett. 202: No. 1, L41-L45 (15 Nov 1975).

AS 295 was discovered originally as a twelfth magnitude star having Hα in emission. It has now been found that the twelfth magnitude star at that position is a normal K giant and that the emission spectrum actually originates in a much fainter star 3" distant (here called AS 295 B), which in addition to bright lines of H, He I, He II, and O I shows a number of the stronger coronal lines such as [Fe II] λ6374 and [Fe XIV] λ5303. The two stars have quite different radial velocities and are probably only aligned. Provided the Fe ions coexist, the coronal line region of AS 295 B must have a T_e of at least 1.25×10^6 K, the true value depending upon the amount of interstellar extinction, while the conventional emission spectrum probably arises in a cooler region having $T_e \simeq 20{,}000$ K. Absolute fluxes measured for Hα and the coronal lines make possible a prediction of the X-ray (2–6 keV) and radio (2.7 GHz) fluxes of AS 295 B. The nondetection of AS 295 B at X-ray wavelengths is understandable. A very weak radio source has been discovered by Gregory and Seaquist at the optical position of AS 295 B, and at a flux density very close to that predicted for the optically thin case. Upon examination of the Maria Mitchell and Harvard plate collections, AS 295 B was found to have undergone a hitherto undetected nova-like outburst in 1965. However, the persistence of its coronal spectrum 10 years later is unprecedented among the novae that have shown coronal lines, although it may be related to the fact that AS 295 B is the slowest nova of the group. (auth)

18048 A NEW CH STAR IN THE GLOBULAR CLUSTER OMEGA CENTAURI. Bond, H.E. (Louisiana State University Observatory). Astrophys. J. Lett. 202: No. 1, L47-L49 (15 Nov 1975).

A photograph of ω Centauri made with a transmission-grating slitless spectrograph has revealed a new CH star near the center of this globular cluster. The star's radial velocity is found to be consistent with cluster membership, and a visual absolute magnitude $M_v = -1.8$ is derived. The total number of carbon stars now known in globular clusters is three, all of which are in ω Cen. (auth)

18049 STATIONARY AXISYMMETRIC ELECTROMAGNETIC FIELDS AROUND A ROTATING BLACK HOLE. Petterson, J.A. (Physics Department, Yale University, New Haven, Connecticut 06520). Phys. Rev. D 12: No. 8, 2218-2225 (15 Oct 1975).

The form of stationary electromagnetic fields which are axisymmetric around a rotating black hole is derived, using Teukolsky's perturbation equation. The field of a circular equatorial charged current loop around the black hole is obtained, and it is shown that in a minimum-energy configuration the black hole and the current loop contain an equal but opposite net charge. The value of this equilibrium net charge is calculated. (auth)

18050 IS THERE A MASER IN THE SILICON MONOXIDE GROUND STATE? Buhl, D. (Astrochemistry Branch, Laboratory for Extraterrestrial Physics, NASA/Goddard Space Flight Center); Snyder. L.E.; Lovas, F.J.; Johnson, D.R. Astrophys. J. Lett. 201: No. 1, L29-L31 (1 Oct 1975).

Observations of the ground state ($v=0$, $J=2$–1) transition of silicon monoxide (SiO) show a rather smooth, low-intensity profile stretching over a large velocity range. The presence of ground-state emission at velocities which are not present in the $v=1$ or $v=2$ lines is interpreted as thermal emission in the ground state in regions where there is insufficient excitation to produce the vibrationally excited masers. Only VY CMa shows a profile which could be interpreted as ground-state maser emission. (auth)

18051 PROPER MOTION OF DC-23° 14002. Grasdalen, G. L. (Kitt Peak National Observatory, Tucson, AZ). Publ. Astron. Soc. Pac.; 87: No. 519, 831(Oct 1975).

The large proper motion of the apparent runaway star CD −23° 14002 is shown to be spurious, The proper motion of this early B star is consistent with its membership and origin in Simeis 188. (auth)

18052 SPECTRAL TYPES IN THE OPEN CLUSTER NGC 2451. Levato, H. (La Plata Observatory, Argentina); Malaroda, S. Publ. Astron. Soc. Pac.; 87: No. 519, 823(Oct 1975).

MK spectral types are provided for 23 stars in the field of the open cluster NGC 2451. Two peculiar stars were found. (auth)

18053 INFLUENCE OF ROTATION AND STELLAR WINDS UPON THE Be PHENOMENON. Massa, D. (Univ. of Colorado, Boulder). Publ. Astron. Soc. Pac.; 87: No. 519, 777-787(Oct 1975).

A number of rapidly rotating B stars, not previously known as Be stars, were observed spectroscopically at H alpha. These results were then combined with existing data to show that the spectral type of a star and the minimum velocity at which it must rotate in order to become a Be star are related. The trend of this relationship is found to have a natural explanation in terms of stellar winds. (auth)

18054 PERIODOGRAM ANALYSIS OF 4 CANUM VENATICORUM. McAlary, C. W.; Percy, J. R. (Univ. of Toronto). Publ. Astron. Soc. Pac.; 87: No. 519, 789-793(Oct 1975).

A periodogram analysis of the delta Scuti star 4 CVn has been carried out using the photometric data of Landolt and the method of Gray and Desikachary. The analysis reveals three frequencies of 3.92, 5.823, and 8.07 cycles day^{-1}; the phases and amplitudes corresponding to these frequencies have been derived. (auth)

18055 PHOTOMETRIC STUDY OF THE ECLIPSING BINARY WX CEPHEI. Ebbighausen, E. G.; Penegor, G.; Straton, P. (Univ. of Oregon, Eugene). Publ. Astron. Soc. Pac.; 87: No. 519, 795-800(Oct 1975).

The photometric elements of the eclipsing binary WX Cep are determined from 3120 photoelectrically measured observations in each of the B and V regions which were obtained in the summer of 1973 at the Pine Mountain Observatory of the University of Oregon. The analysis shows that primary minimum is produced by the occulation of the smaller, fainter type A2 star by the large brighter star of about type A5, and that during the 10.9-hour duration of the primary eclipse it is total for about 40 minutes. The existing spectroscopic data (of uncertain quality) for this double-line binary are used to estimate the mass and radius of each component. Both components have about one solar mass which is somewhat smaller than expected for these spectral classes even if the luminosity class of each star is V. (auth)

18056 FINDING LIST OF B AND A STARS NEAR THE GLOBULAR CLUSTER M22. Philip, A. G. D.; Goodman, B. M. (State Univ. of New York, Albany). Publ. Astron. Soc. Pac.; 87: No. 519, 801-815(Oct 1975).

A catalog of 27 B and A stars is presented with spectral types, magnitudes, and positions. The catalog is intended to provide a list of stars to be observed for determination of the color excess in front of M22 (NGC 6656). (auth)

18057 PHOTOELECTRIC PHOTOMETRY OF THE delta SCUTI STAR HR 5005. Jerzykiewicz, M. (Wroclaw Univ. Observatory). Publ. Astron. Soc. Pac.; 87: No. 519, 817-820(Oct 1975).

About 150 photoelectric observations of HR 5005 are reported. The delta Scuti-type variability of the star is confirmed. On the basis of the light range changes and the distribution of the epochs of maximum light, it is conjectured that HR 5005 has a fairly long beat period. One of the two comparison stars used, probably HR 5014, is found to be slightly variable. The light range amounts to about 0.015 m. (auth)

18058 TILTED RING MODEL FOR THE ECLIPSING BINARY RS CANUM VENATICORUM. Oliver, J. P. (Univ. of Florida, Gainesville). Publ. Astron. Soc. Pac.; 87: No. 519, 695-697(Oct 1975).

The tilted equatorial ring model of Catalano and Rodono is discussed and major weaknesses are pointed out. (auth)

18059 VELOCITY DISPERSION OF NEARBY M DWARFS. Krisciunas, K. (Univ. of California, Santa Cruz). Publ. Astron. Soc. Pac.; 87: No. 519, 699-703(Oct 1975).

It is shown that the velocity dispersion of a large sample of stars can be determined by their distribution on the sky as a function of angular distance from the solar apex. Known or suspected M dwarfs from Gliese's catalog were divided into groups according to distance from the sun, angular distance from the solar apex, whether or not the stars had emission lines, and whether or not they were members of binary or multiple systems. It was found that with this method only a lower limit of the transverse velocity dispersion could be derived. This value was 13 km sec^{-1}. Based on the present technique and the presently available data, the existence of low-velocity M dwarfs cannot be ruled out. (auth)

18060 NEW PLANETARY NEBULA IN PUPPIS. Sanduleak, N. (Case Western Reserve Univ., Cleveland). Publ. Astron. Soc. Pac.; 87: No. 519, 705(Oct 1975).

The discovery of a new planetary nebula is reported. (auth)

18061 STATISTICAL IDENTIFICATION OF BINARIES IN STAR CLUSTERS. Bettis, C. Publ. Astron. Soc. Pac.; 87: No. 519, 707-715(Oct 1975).

A technique is presented for identifying binary systems using computer curve-fitting methods applied to the color-magnitude diagrams of individual star clusters (Hyades, Pleiades, and Praesepe). The technique seems to be dependable and free of most of the troublesome selection effects that bias other binary-star survey methods. Scatter in the color-magnitude diagram is discussed, and it is concluded that the main sequence of a galactic cluster is one dimensional within current observational error. The frequency of binaries in the analyzed clusters is discussed, and it appears that the Hyades has a somewhat higher percentage of binaries than the other two clusters. The effect of unresolved binaries on the distance determination of galactic clusters by main sequence fitting is analyzed. (auth)

18062 SPECTROSCOPIC ORBIT FOR THE ECLIPSING BINARY IQ PERSEI. Young, A. (San Diego State Univ., CA). Publ. Astron. Soc. Pac.; 87: No. 519, 717-719(Oct 1975).

Spectroscopic orbital elements are derived for the eclipsing binary IQ Per. Faint secondary lines are detected, and a mass ratio and individual masses are inferred. The components are found to be on the main sequence, and the system is detached. (auth)

18063 FOUR-COLOR AND H beta PHOTOMETRY FOR OPEN CLUSTERS I: NGC 2516. Snowden, M. S. Publ. Astron. Soc. Pac.; 87: No. 519, 721-734(Oct 1975).

Extensive uvby and H beta photometry was obtained for stars in the region of the open cluster NGC 2516. A photometric analysis revealed variable reddening and a mean reddening of E(b - y) equals 0.088 m. In addition to determining a new age of 137 x 10^6 years and a new adopted distance modulus of 8.01 m, several possible new variable stars were discovered, one of which may be an eclipsing Ap star. From the photometry of the Si-lambda4200 stars in the cluster it appears the absolute magnitudes and masses for this type of star are not as restricted as previously thought. (auth)

18064 GAUSSIAN COMPONENTS OF VELOCITY DISTRIBUTIONS OF GIANT STARS. Dessureau, R. L. (United Aircraft Corp., East Hartford, CT); Upgren, A. R. Publ. Astron. Soc. Pac.; 87: No. 519, 737-743(Oct 1975).

An investigation of the velocity distribution of giant stars perpendicular to the galactic plane has been made using a new determination of their space densities in the region of the north galactic pole. These densities, together with the K(z) force as determined by Oort, give rise to a total velocity distribution which is well represented by three Gaussian distributions. A stable and realistic model is achieved with no constraints imposed upon the parameters of each velocity distribution. The relative abundances and mean velocities of the distributions differ markedly from Oort's results; in particular, his conclusion that a small component of stars of very high velocity is necessary to satisfy the density requirements is not supported here. It is concluded that his values of K(z) cannot be reconciled with his distributions, but many more radial velocities of high-latitude giant stars are needed to identify the cause of the discrepancy. (auth)

18065 ULTRAVIOLET PHOTOMETRY AND SPECTROPHOTOMETRY OF ALGOL. Eaton, J. A. (Univ. of Wisconsin, Madison). Publ. Astron. Soc. Pac.; 87: No. 519, 745-751(Oct 1975).

OAO-2 ultraviolet light curves and spectrophotometry of the Algol system are presented and used to establish effective temperatures and luminosities for the three components. The values derived are given. (auth)

18066 SPECTRUM VARIABILITY IN HD 148688 AND Zeta[1] SCORPII. Walborn, N. R. (Cerro Tololo Inter-American Observatory, La Serena, Chile). Publ. Astron. Soc. Pac.; 87: No. 519, 759-761(Oct 1975).

Equivalent-width measurements are given for lines in the spectra of the luminous, early-B supergiants HD-148688 and zeta[1] Sco. Recently reported large, rapid variations in the spectra of these stars are not observed. (auth)

18067 HYDRODYNAMIC EFFECTS IN THE ATMOSPHERES OF VARIABLE STARS. Davis, C. G. (Los Alamos Scientific Lab., NM). Mem. Soc. R. Sci. Liege; 8: No. 6, 197-207(1975).

Numerical models of variable stars are established, using a non-linear radiative transfer coupled hydrodynamics code. The variable Eddington method of radiative transfer is used. Comparisons are for models of W Virginis, β Doradus and η Aquilae. From these models it appears that shocks are formed in the atmospheres of classical Cepheids as well as W Virginis stars. In classical Cepheids the bumps appearing in the light and velocity curves, for stars with periods from 7 to 10 days, appear as the result of a compression wave that reflects from the star's center in agreement with Christy. At the head of the outward going compression wave shocks form in the atmosphere. Comparisons between the hydrodynamic motions in W Virginis and classical Cepheids are made. The strong shocks in W Virginis do not penetrate into the interior as do the compression waves formed in classical Cepheids. The shocks formed in W Virginis stars cause emission lines while in classical Cepheids the shocks are weaker and their existence may possibly be evidenced in the recent ultraviolet (uv) data obtained via the O. A. O. satellite. (auth)

18068 NEW BINARY PULSAR AND THE OBSERVATION OF GRAVITATIONAL SPIN PRECESSION. Hari Dass, N. D. (Indian Inst. of Science, Bangalore); Radhakrishnan, V. Astrophys. Lett.; 16: No. 4, 135-139(1975).

The spin precession effect due to a spin-orbit type coupling is studied. Information from the pulsar on pulse structure aids in an analysis of relevant physical effects. (BJG)

18069 STAR DISTRIBUTION IN M15. Bahcall, J. N. (Inst. for Advanced Study, Princeton, NJ); Bahcall, N. A.; Weistrop, D. Astrophys. Lett.; 16: No. 4, 159-163(1975).

Star counts are reported that extend to within about 0.5 pc of the center of the globular star cluster M 15. Combining our results with previous surface brightness measurements, the best-fitting parameters are derived for the star distribution (core radius = 0.4 pc, central density = 4.5×10^4 $M_\odot/pc^3$) as well as for the limits that can be placed on the mass of a central massive black hole ($M_{BH} \lesssim 8 \times 10^3$ $M_\odot$). (auth)

18070 RR LYRAE STARS IN THE SMALL MAGELLANIC CLOUD. Graham, J. A. (Cerro Tololo Inter-American Observatory, La Serena, Chile). Publ. Astron. Soc. Pac.; 87: No. 519, 641-682(Oct 1975).

A field covering an area $1^0 \times 1.3^0$ in an outlying region of the Small Magellanic Cloud (SMC) is searched for variable stars. Ninety-two variables were identified and periods were determined for 77 of these. Seventy-six stars have periods less than a day and amplitudes of several tenths of a magnitude, and are probably variables of the RR Lyrae type. Ten yellow and red variables with periods longer than a day are briefly described. Multiple discovery statistics suggest a completeness of 93 percent for variables of Bailey class ab and 50 percent for those of Bailey class c. Approximately 30 percent of the RR Lyrae variables show variations in amplitude and/or phase of maximum or minimum light. The period distribution is unlike that found anywhere in the Galaxy, and resembles most closely that of the variables in the Leo II dwarf galaxy. There is some evidence that, for a given period, the SMC variables tend to have smaller amplitudes than Galactic RR Lyrae stars. The mean blue magnitudes of the SMC variables peak sharply at (B) equals 20.0 m. The mean, (anti B), for all RR Lyrae variables with known periods and with (B) greater than 19.0 m is 19.95 m. Measurements of three yellow plates give a similar mean, (anti V), equals 19.57 m for this same group. For a distance modulus of 19.0 m for the SMC, a mean absolute visual magnitude of +0.6 m $\pm$ 0.25 m is found for the RR Lyrae stars in the SMC. It is suggested that the RR Lyrae stars are distributed rather evenly over the SMC and concentrate neither toward the central bar nor towards the center of the SMC system adopted by Westerlund. (auth)

18071 NON-ADIABATIC RADIAL OSCILLATIONS AND PULSATIONAL STABILITY OF HOT DEGENERATE DWARFS. Sion, E. M. Philadelphia; Univ. of Pennsylvania (1975). 110p. University Microfilms Order No. 75-24,129.

Thesis (Ph. D.).

A sequence of one solar mass degenerate stellar models has been calculated having carbon-oxygen cores and helium envelopes. The models lie in the luminosity range -3 less than or equal to Log (L/L/sub sun/) less than or equal to 4. The models were analyzed for multimodal pulsational properties and stability using a linear, quasi-adiabatic approach. In the luminosity range 0 less than or equal to Log (L/L/sub sun/) less than or equal to 4, helium nuclear reactions near the surface provide a strong driving effect and the effect of helium shell burning on pulsational stability is discussed. In the luminosity range -3 less than or equal to Log (L/L/sub sun/) less than or equal to -1, the effects of the partial ionization zones of He I and He II are included in the stability analysis. Numerical values for periods, eigenfunctions and stability integrals are obtained. The possible applications of the results to pulsating X-ray sources, DB white dwarfs, and helium shell burning stars are presented and discussed. (Diss. Abstr. Int., B)

18072 ANALYTIC SUPERNOVA MODELS. Adams, R. C. Philadelphia; Univ. of Pennsylvania (1975). 156p. University Microfilms Order No. 75-24,037.

Thesis (Ph. D.).

This thesis presents a method of obtaining analytic solutions to the equations of general relativity and of thermal structure. By inverting the usual procedure of astrophysics, the time-dependent, spherically symmetric field equations in the comoving frame can be reduced to quadratures. New analytic solutions are obtained that describe stars collapsing to black holes while losing up to 60 percent of their masses in the form of electromagnetic radiation. The equation of state is almost polytropic. Also presented is a solution describing a star that radiates enough mass away to avoid becoming a black hole. By "dejuicing the baryon," the entire mass is radiated to infinity, leaving only baryons without mass in the star. The description of a supernova in terms of a fluid is cast into doubt. To obtain such quantities as the mass, radius, and luminosity observed at infinity from those determined in the comoving frame, the solutions must be matched across a moving boundary by requiring the continuity of the first and second fundamental forms. Such a boundary condition implies the continuity of the radial components of the stress energy tensor (T^{11} and T^{01}). Another boundary condition familiar to astrophysicists from the standard model is the radiative zero. This implies a discontinuous stress energy tensor in the radial direction. The major differences between the two models are that more mass is radiated, the equation of state is softer, and the mass of the black hole is less for the radiative zero. All other characteristics differ only slightly. It is hoped that these analytic solutions will settle a few of the disputes in supernova theory. (Diss. Abstr. Int., B)

18073 MODELS OF THE UPPER PHOTOSPHERES OF THE SUN AND ARCTURUS BASED ON MOLECULAR SPECTRA. Mount, G. H. Boulder, CO; Univ. of Colorado (1975). 228p. University Microfilms Order No. 75-23,626.

Thesis (Ph. D.).

Accurate photoelectric center-limb spectra of the solar CN and CH molecules and CN spectroheliograms have been obtained at Kitt Peak National Observatory. These observations, together with observations of the solar CO fourth positive EUV system and the Griffin Arcturus Atlas, have been compared with theoretical LTE and non-LTE spectra of CN, CH, and CO in the Sun and CN in Arcturus (K2 III). The molecular line source functions deviate significantly in all cases from the Planck function, and thus we find that non-LTE effects are critical in interpreting molecular spectra in the Sun and Arcturus. (Diss. Abstr. Int., B)

18074 SURVEY OF PULSATION IN RR LYRAE STAR MODELS. Spangenberg, W. H. Boulder, CO; Univ. of Colorado (1975). 237p. University Microfilms Order No. 75-23,649.

Thesis (Ph. D.).

A survey of pulsation in model envelopes of RR Lyrae stars has been completed. Approximately forty models were calculated in both the fundamental mode and first harmonic mode until the limiting amplitude was reached either in the original imposed mode or in the alternate mode if the model switched its pulsation characteristics. All models have a mass of 0.6 M/sub solar mass/ and a composition: X equals 0.70, Y equals 0.299, and Z equals 0.001. A sequence of models in effective temperature was constructed at each of six luminosities in the range 1.6 less than or equal to log L/L/sub solar mass/ less than or equal to 2.1. Effective temperatures considered were in the range 6000°K less than or equal to T/sub e/ less than or equal to 7500°K. All the envelopes had an inner boundary radius less than one-tenth the photospheric radius. To aid in the interpretation of the nonlinear survey results, a linear, nonadiabatic analysis was performed on the models as well. Two significant improvements in mathematical techniques over previous nonlinear pulsation calculations were incorporated into the computer code. A grey radiative transport treatment (nonequilibrium diffusion) was combined with the standard one-dimensional Lagrangian explicit hydrodynamics approach to follow the pulsation in time. The results of the modal stability survey point to the existence of three regions of characteristic limiting amplitude behavior within the instability strip. The characteristics and nature of the full amplitude pulsation have been studied along with the systematic variations of the pulsation with effective temperature and luminosity. (Diss. Abstr. Int., B)

18075 SPECIAL RELATIVISTIC MECHANICS AND ELECTRODYNAMICS WITH APPLICATIONS TO SYNCHROTRON RADIATION. Romig, J. H. Boulder, CO; Univ. of Colorado (1975). 225p. University Microfilms Order No. 75-23,639.

Thesis (Ph. D.).

The underlying physics of synchrotron radiation and its treatment in the literature is examined here. It is found that the orbit changes in the angle between the particle's retarded velocity and the line of sight vector exceed the beam-width of the emission; thus, the synchrotron radiation from a single particle generally consists of only one pulse or perhaps several pulses of different character unevenly spread in time, rather than an endless sequence of pulses of identical character evenly spaced in time as is currently assumed in the literature. This realization leads to a number of important conclusions. The spectral character of the synchrotron radiation within the source itself must be different than currently thought; thus, the estimates of the degree of synchrotron self-absorption must be reexamined. The low-frequency cut-offs in the emission that are believed to arise from small pitch angle synchrotron radiation can occur at higher frequencies. Third, the particle's distribution function is stochastic in character rather than smooth and static as is usually assumed. The power output from a system of particles, of course, is still proportional to the number of particles but the proportionality constant may be different. If so, the estimates of the particle numbers and hence the source energetics will change. The above effects are situation dependent; they occur when the magnetic field is weak and the particle energies are high. Applications to Jupiter and the Crab Nebula are considered. (Diss. Abstr. Int., B)

Quasi-Stellar, Radio, and X-Ray Sources

Refer also to abstracts 17952, 17967, 17990, 18004, 18026, 18030, 18044, 18045, 18071, 18075, 18184, 18206, 18209, 18210, and 18252.

18076 PARAMETERS OF CEN X-3 DEDUCED FROM OBSERVATIONS OF ITS ACCRETION WAKE. Jackson, J. C. (Leicester Univ., Eng.). Mon. Not. R. Astron. Soc.; 172: No. 3, 483-492(Sep 1975).

Recent observations of Cen X-3 show a dip in its light curve around phase 0.6. This is interpreted as being due to electron scattering in a dense wake, via which the secondary accretes material from a primary stellar wind. The phase and width of the dip yield estimates of the wind velocity and temperature. The optical depth in the wake is a function of the accretion rate to secondary mass ratio, enabling this quantity to be determined. The absorption optical depth in the stellar wind is derived and is also a function of the accretion rate and secondary mass. Assuming that the observed transition from a low to a high intensity state is caused by a fall in the wind strength, the accretion rate and secondary mass are found separately. The neutron star mass so derived is in the range $\frac{1}{4}$ to $\frac{1}{2}$ $M_{\odot}$. The accretion rate gives the intrinsic luminosity of the source, which yields a distance ~2.4 Kpc. (auth)

18077 RADIO SOURCE MODELS WITH VERY SMALL PITCH ANGLE PARTICLES. Callahan, P. S. (Oxford Univ.). Mon. Not. R. Astron. Soc.; 173: No. 1, 111-120(Oct 1975).

Formulae for the emission by very small pitch angle electrons are used to derive the parameters of self-consistent radio source models from observational data. It is found that while no observed radio source requires emission from very small pitch angle particles, emission from small pitch angle particles may contribute in some sources. (auth)

18078 TEMPORAL BEHAVIOR OF TAURUS X-1 (THE CRAB NEBULA). Davison, P. J. N. (Mullard Space Science Lab., Dorking, Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 77-83.

Copernicus data on Taurus X-1 and the Crab pulsar extending over a $2\frac{1}{2}$-yr period indicate that under normal conditions the source has a flux that is constant to within 2.5 percent at the 90 percent confidence level. The pulsed/total flux ratio also shows no significant changes during the same time. (auth)

18079 OBSERVATION OF CEN X-3 WITH THE ARIEL-5 SKY SURVEY. Pounds, K. A.; Cooke, B. A.; Ricketts, M. J.; Turner, M. J.; Elvis, M. (Leicester Univ., Cambridge, Eng.). Mon. Not. R. Astron. Soc.; 172: No. 3, 473-481(Sep 1975).

A continuous observation of Cen X-3 over 8 cycles of the binary period was carried out in 1974 November with the Leicester Sky Survey experiment on board the Ariel-5 satellite. During these observations the source was seen to change from a low to a high intensity state and evidence is found for X-ray attenuation by both the primary stellar wind and the accretion wake formed beyond the neutron star. (auth)

18080 SLOWLY ROTATING NEUTRON STARS AND TRANSIENT X-RAY SOURCES. Fabian, A. C. (Cambridge Univ., Eng.). Mon. Not. R. Astron. Soc.; 173: No. 1, 161-165(Oct 1975).

A neutron star in a weak stellar wind from a binary companion will spindown because of pulsar emission and the "propeller" mechanism of Illarionov and Sunyaev. Large density fluctuation in this wind can then turn the neutron star into a transient X-ray source with a relatively long rotation period. The transient X-ray source, Ariel 1118-61, which has a period of 6.75 min is shown to be in general agreement with the above considerations. (auth)

18081 GENERAL CHARACTER OF THE X-RAY EMISSION FROM COMPACT OBJECTS IN CLOSE BINARY STARS. Li-chih, F. (Univ. of Science and Tech. of China, Peking). Tzu Tung Hua Hsueh Pao; 16: No. 1, 19-26(Jun 1975). (In Chinese).

The mechanism of emission from X-ray sources in close binary stars is studied. It is suggested that pair production may play an important role in the X-ray emission region which is formed by the accretion of a compact object (a neutron star or a black hole). The present model accounts qualitatively for the following observed general properties in X-ray binaries: The X-ray luminosity lies within the range 10^{36}-10^{38} erg/sec. The X-ray energy spectrum can in the majority of cases be represented by either the power-law or the thermal bremsstrahlung form. The temperature of the thermal bremsstrahlung spectrum is in the order of 10^8 K. The form of the energy spectrum does not change appreciably when the luminosity fluctuates. (JPRS)

18082 DISCRETE X-RAY AND γ SOURCES. Gnedin, Yu. N. (Ioffe Inst. of Physics and Tech., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 139-145(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 408-416(1975).

Observational data and theoretical considerations regarding the x-ray sources in binary systems are analyzed. The results of observations and certain models for cosmic γ bursts are discussed. (auth)

18083 POSSIBILITY OF GRAVITATIONAL EFFECT IN THE SPECTRA OF QUASI-STELLAR OBJECTS. Durgapal, M. C. (Jodhpur Univ., India). J. Phys., A (London); 8: No. 10, 1697-1705(Oct 1975).

It is shown that quasi-stellar objects are most probably situated at cosmological distances. The large redshifts of these objects cannot be due to surface gravitational effects. The Hoyle-Fowler model perhaps holds a last hope of attributing redshift to gravity. Different cluster solutions have been analyzed to formulate a suitable Hoyle-Fowler model. A modified Hoyle-Fowler model may explain the emission spectrum of quasars, but such a model developed in this paper fails to give a satisfactory explanation of absorption spectra. However, a Hoyle-Fowler model at cosmological distance may possibly explain sharpness and depth of absorption lines. The Hoyle-Fowler model which was originally designed to provide a non-cosmological model of quasi-stellar objects provides a more satisfactory result if it is at a cosmological distance. (auth)

18084 SPECTRAL INTENSITY DEPENDENCE AND ISOTROPY OF SOURCES STRONGER THAN 0.1 Jy AT 2700 MHz. Balonek, T.J.; Broderick, J.J. (National Astronomy and Ionosphere Center, Arecibo, Puerto Rico); Condon, J.J.; Crawford, D.F.; Jauncey, D.L. Astrophys. J. 201: No. 1, 20-25 (1 Oct 1975).

The 1000-foot (305 m) telescope of the National Astronomy and Ionosphere Center was used to measure 430 MHz flux densities of sources stronger than 0.1 Jy at 2700 MHz. Distributions of the resulting two-point spectral indices α (430, 2700) of sources in the intensity range $0.1 \leq S < 0.35$ Jy were compared with α (318, 2700) distributions of sources stronger than 0.35 Jy at 2700 MHz. The median normal-component spectral index and fraction of flat-spectrum sources in the faintest sample do not continue the previously discovered trend toward increased spectral steepening of faint sources. This result differs from the prediction of simple evolutionary cosmological models and therefore favors the alternative explanation that local source-density inhomogeneities are responsible for the observed intensity dependence of spectral indices. (auth)

18085 SPECTROPHOTOMETRY OF LOW-REDSHIFT QUASI-STELLAR OBJECTS. Baldwin, J.A. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz). Astrophys. J. 201: No. 1, 26-44 (1 Oct 1975).

Emission line strengths, low-resolution line profiles, and continuum energy distributions were measured for 14 low-redshift QSOs. The profiles of many of the broad emission lines are quite symmetrical and are in excellent agreement either with electron-scattering profiles, or, as has been shown by Blumenthal and Mathews, with the profiles expected for mass loss driven by radiation pressure, but some of these QSOs have asymmetrical broad lines which necessarily involve mass motions at high velocities. The Balmer decrements are considerably steeper than is predicted by recombination theory, implying that there is either reddening or at least some collisional excitation. Helium is found to have a normal abundance in these QSOs. The narrow [O III] and [Ne III] line strengths are consistent with heating by photoionizations, but the [O II] λ3727 line strengths are much stronger than can be easily explained by existing models. (auth)

18086 FURTHER OBSERVATIONS OF BL LACERTAE. Thuan, T.X.; Oke, J.B.; Gunn, J.E. (Hale Observatories, California Institute of Technology, Carnegie Institution of Washington). Astrophys. J. 201: No. 1, 45-49 (1 Oct 1975).

New spectrophotometric observations of BL Lac, using either a 7″ diameter aperture or a 3.″7-10″ diameter annulus, have been obtained under conditions of fair to excellent seeing and with BL Lac near the zenith. The nucleus was faint for all observations. Four absorption features identified as the Mg I and MgH band, the λ4410 band, the G-band, and H and K of Ca II, are observed. The redshift is $z=0.070\pm0.005$ in agreement with results in a previous paper. When the effects of the radiation from the central bright source are removed as well as possible, the residual spectral energy distribution is found to be very similar to that of a standard giant elliptical galaxy redshifted by $z=0.070$ and reddened corresponding to $E_{B-V}=0.28$ to 0.40. The absolute visual magnitude of the underlying galaxy is -22.6 if $H_0=60$ km s^{-1} Mpc^{-1} and $E_{B-V}=0.28$. (auth)

18087 RESULTS OF A SOUTHERN-HEMISPHERE SEARCH FOR GAMMA-RAY SOURCES AT $E_\gamma \geq 3\times10^{11}$ eV. Grindlay, J.E.; Helmken, H.F. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory); Brown, R.H.; Davis, J.; Allen, L.R. Astrophys. J. 201: No. 1, 82-89 (1 Oct 1975).

The optical intensity interferometer operated by Sydney University at Narrabri, NSW, Australia, was converted in 1972 April to a sensitive detector of atmospheric Cerenkov light from extensive air showers (EAS) with $E_0 > 2\times10^{11}$ eV. Its two 7-m aperture optical reflectors were separated by 120 m and pointed by computer at the mean altitude for the maximum development of EAS from the direction of an object to be studied. Off-axis photomultipliers on the reflectors viewed the atmospheric Cerenkov light from EAS muon cores, thus enabling rejection of $\gtrsim 50$ percent of EAS detected as being cosmic-ray-initiated. Possible ($\gtrsim 3\,\sigma$) sources were found in 1972 in the directions of Cen A (NGC 5128), the Vela Pulsar, and MP 1451, out of 11 candidate objects studied. The objects included pulsars, unusual X-ray sources, active galaxies, a supernova, and lower energy ($\sim$100 MeV) γ-ray sources such as the galactic center. (Confirmation of the 1972 results was attempted in an improved series of observations in 1973 April-June and 1974 March-April. The Cen A result was confirmed and is reported elsewhere. Upper limits are given here for the other objects, together with evidence for a variable pulsed flux from the Vela Pulsar. Implications of the results are discussed. (auth)

18088 THE RADIO SPECTRA OF MASS-OUTFLOW STARS. Marsh, K.A. (CRESS, York University, Toronto). Astrophys. J. 201: No. 1, 190-193 (1 Oct 1975).

The occurrence of radio spectra of the approximate form $S_\nu \propto \nu^{+1}$ in emission-line stars with infrared excesses can be explained by a model in which mass outflow is the dominant characteristic of the extended stellar atmosphere. An unbounded spherically-symmetric inverse-square density distribution of ionized gas would produce a spectrum of the form $S_\nu \propto \nu^{0.6}$. The fact that the measured radio spectral indices are significantly greater than 0.6 can be explained in terms of an inverse-square distribution which has been truncated at some finite outer radius. This simple model provides a good fit to the observed spectrum of the three radio sources considered here, namely Vy 2-2, Hb 12, and V1016 Cygni. (auth)

18089 SPECTRAL VARIABILITY OF CYGNUS X-3. Serlemitsos, P.J.; Boldt, E.A.; Holt, S.S.; Rothschild, R.E. (NASA/Goddard Space Flight Center); Saba, J.L.R. Astrophys. J. Lett. 201: No. 1, L9-L13 (1 Oct 1975).

Spectra of Cyg X-3 from 1.7 to 40 keV obtained about a year apart using the same rocket payload show large spectral differences. The two observations suggest that while the luminosity of this source remains roughly the same, its spectrum can vary from a featureless blackbody distribution to a flat spectrum which includes strong iron line emission at $\sim$6.7 keV. The flux in the line is 0.018 ± 0.004 photons cm^{-2} s^{-1}, corresponding to an equivalent continuum width of 1.2 keV. (auth)

18090 THE CRAB NEBULA: HIGH ENERGY X—RAY OBSERVATION OF A LUNAR OCCULTATION. Staubert, R.; Kendziorra, E.; Trümper, J. (Astronomisches Institut der Universität Tübingen); Reppin, C.; Hoffman, J.A.; Pounds, K.A.; Giles, A.B.; Morrison, L.V. Astrophys. J. Lett. 201: No. 1, L15-L19 (1 Oct 1975).

A lunar occultation of the Crab Nebula was observed at X-ray energies above 15 keV by a scintillation counter on a Skylark rocket launched from Spain on 1974 October 7. The angular extent of the region of emission of 75 percent of the total flux between 15 and 150 keV (average photon energy 39 keV) along position angle 263° is found to be 110″+25″. The offset of the centroid of the extended source is such that its projection to the west of NP 0532 is 8′.±6′. The variation of size with energy, as found from this and other measurements, sets constraints on models for energy transfer along magnetic field lines in the Crab. (auth)

18091 OBSERVATIONS WITH A VLB ARRAY. I. INTRODUCTION AND PROCEDURES. Cohen, M.H.; Moffet, A.T.; Romney, J.D.; Schilizzi, R.T. (Owens Valley Radio Observatory, California Institute of Technology); Shaffer, D.B.; Kellermann, K.I.; Purcell, G.H.; Grove, G.; Swenson, G.W. Jr.; Yen, J.L.; Pauliny-Toth, I.I.K.; Preuss, E.; Witzel, A.; Graham, D. Astrophys. J. 201: No. 2, 249-255 (15 Oct 1975).

We describe a series of observations intended to investigate the structure and the time development of the structure of compact extragalactic radio sources at $\lambda = 2.8$ cm and resolution 0.″001. In this paper we discuss the five telescopes, the sensitivity of the system, the calibration procedures, and modeling procedures. (auth)

18092 OBSERVATIONS WITH A VLB ARRAY. II. THE SOURCES 4C 39.25, NRAO 150, VRO 42.22.01, 3C 345, AND 3C 454.3. Shaffer, D.B. (Yale University Observatory); Cohen, M.H.; Romney, J.D.; Schilizzi, R.T.; Kellermann, K.I.; Swenson, G.W. Jr.; Yen, J.L.; Rinehart, R. Astrophys. J. 201: No. 2, 256-262 (15 Oct 1975).

Three-antenna long-baseline interferometry at 10.7 GHz is reported for NRAO 150, 4C 39.25, 3C 345, VRO 42.22.01, and 3C 454.3 for several epochs between 1972 April and 1974 February. Simple models for the source brightness distributions fit the observations and indicate that most of the radio emission comes from one or two components. Component separations range up to ~50 lt-yr, and component sizes are on the order of 10 lt-yr. Small variations in source structure have been observed. (auth)

18093 OBSERVATIONS WITH A VLB ARRAY. III. THE SOURCES 3C 120, 3C 273B, 2134+004, AND 3C 84. Schilizzi, R.T.; Cohen, M.H.; Romney, J.D. (Owens Valley Radio Observatory, California Institute of Technology); Shaffer, D.B.; Kellermann, K.I.; Swenson, G.W. Jr.; Yen, J.L.; Rinehart, R. Astrophys. J. 201: No. 2, 263-274 (15 Oct 1975).

The sources 3C 120, 3C 273B, 2134+004, and 3C 84 have been observed at several epochs at 2.8 cm using a multielement very-long-baseline interferometer (VLBI). The resulting visibility data show that the brightness distributions of each source are variable. There are large changes in the visibilities of 3C 120 and 3C 273B on a time scale of months. For 3C 120, and perhaps 3C 273B, the changes can be explained by source distributions in which the components are separating at high (probably relativistic) speeds. (auth)

18094 AO 0235+164—A RED BL LACERTAE OBJECT. Spinrad, H. (Astronomy Department, University of California, Berkeley); Smith, H.E. Astrophys. J. 201: No. 2, 275-276 (15 Oct 1975).

AO 0235+164, an inverted-spectrum radio source identified with a faint red stellar object, is shown to be an optical/radio variable. This plus its featureless optical spectrum lead us to classify AO 0235+164 as an object similar to BL Lacertae. (auth)

18095 ON THE LIGHT CURVE OF 3C 273. Fahlman, G.G. (Institute of Astronomy and Space Science, University of British Columbia); Ulrych, T.J. Astrophys. J. 201: No. 2, 277-286 (15 Oct 1975).

The historical light curve of 3C 273 is analyzed using the technique of autoregressive (AR) decomposition. The observed optical fluctuations are regarded as the output of a linear system whose input is shot noise. The AR representation of this process is computed in a way consistent with the principle of maximum entropy and makes use of the Akiake final prediction error criterion for choosing the order of the process. Inversion of the AR parameters yields the minimum delay impulse response of the linear system. The technique further allows the computation of the optimally smoothed maximum entropy power spectrum. Numerical examples based on the shot-noise model of 3C 273 discussed by Terrell and Olsen are presented. The application to the observed light curve of 3C 273 indicates that (1) no low-frequency cyclic component is present and (2) the characteristic optical pulse responsible for the observed variability *qualitatively* resembles the light curve of a supernova. However, the time scale is one order of magnitude longer and, at the cosmological distance of 3C 273, the total energy release in the pulse is some three orders of magnitude greater than for conventional supernovae. (auth)

18096 COMMENTS ON THE USE OF THE LIMITING VOLUME TEST. Barnothy, J.M. (833 Lincoln Street, Evanston, Illinois 60201). Astrophys. J. 201: No. 2, 287-288 (15 Oct 1975).

It is shown that inferences reached from the application of the limiting volume test to quasars, presupposes the knowledge of the cosmological model of our universe. (auth)

18097 LIGHT-CURVE ANALYSIS OF X—RAY BINARIES: A REVISION. Hutchings, J.B. (Dominion Astrophysical Observatory, Victoria, British Columbia). Astrophys. J. 201: No. 2, 413-414 (15 Oct 1975).

A correction to the light-curve analyses previously published shows that most systems appear to fill their Roche lobes. The mass estimates are not significantly changed. (auth)

18098 ON THE ENERGETICS OF PULSATING X—RAY SOURCES. Guthrie, P.D.; Tademaru, E. (Department of Physics and Astronomy, University of Massachusetts, Amherst). Astrophys. J. 201: No. 2, 415-418 (15 Oct 1975).

We consider nuclear and kinetic energy of accreting matter as possible energy sources for white dwarf models of the pulsating X-ray sources. It is argued that the rate of kinetic energy accretion determines the source luminosity, and the equilibrium velocity amplitude of the pulsation is determined. We also consider inverse Compton cooling of accretion shocks and find that it is generally a small effect. (auth)

18099 THE ORIGIN OF THE NONTHERMAL RADIATION OF QUASI-STELLAR OBJECTS AND GALACTIC NUCLEI. Opher, R. (Physics Department, Technion-Israel Institute of Technology, Haifa, Israel). Astrophys. J. 201: No. 2, 526-531 (15 Oct 1975).

The supermassive star model for the origin of the nonthermal luminosity L_{nt} of QSOs and galactic nuclei is discussed. The basic model analyzed is the combined model of moving magnetic fields for the accelerating mechanism of ultrarelativistic particles and gravitational collapse for the energy source. For this combined model $L_{nt} \simeq L_{uv} \simeq \eta\,(R/R_s)^{-1}(Mc^2)\,\tau^{-1}$, where τ is the lifetime of the source, M and R are its mass and radius, R_s is its Schwarzschild radius, and L_{uv} is the luminosity of ultrarelativistic particles. The accelerating efficiency, η, has in general been assumed to be close to unity. Various previously proposed magnetic accelerating field models are analzyed in detail. It is shown for these models that observational and theoretical evidence indicate that η is not on the order of unity but is most likely less than 1 percent. The implication of this result to the rate of mass loss of QSOs and galactic nuclei is discussed. (auth)

18100 HERCULES X-1: A NEUTRON STAR WITH A TWISTED ACCRETION DISK? Petterson, J.A. (Astronomical Institute University of Amsterdam, The Netherlands). Astrophys. J. Lett. 201: No. 2, L61-L64 (15 Oct 1975).

A model is proposed for the binary X-ray source Her X-1, in order to explain its 35-day periodicity. It consists of a normal star and a neutron star with a twisted accretion disk. The 35-day clock in the model is provided by a precession of the normal star. The disk is responsible for a periodic obscuration of the pulsed X-rays, causing the ON-OFF behavior. The twisted shape of the disk, which arises naturally from the precession of the normal star, is shown to explain a considerable number of X-ray and optical observations. (auth)

18101 THE SPECTROSCOPIC BINARY SCORPIUS X-1. Cowley, A.P.; Crampton, D. (Dominion Astrophysical Observatory, Victoria). Astrophys. J. Lett. 201: No. 2, L65-L68 (15 Oct 1975).

Recent spectroscopic observations of Sco X-1 show conclusively that orbital velocity variations of $P = 0^d.787 \pm 0^d.006$ and a range ~120 km s^{-1} are present in both the He II and H emission lines. The most probable masses are less than 2 $M_\odot$ for each star. We suggest that the nondegenerate companion is somewhat evolved from the main sequence. (auth)

18102 ANALYSIS OF GHOST SPECTRA WHICH SIMULATE THE ABSORPTION-LINE SPECTRUM OF 4C 05.34. Varshni, Y.P. (Department of Physics, University of Ottawa, Ontario). Astrophys. J. 201: No. 3, 547-550 (1 Nov 1975).

Ten ghost spectra which simulate the absorption-line spectrum of the QSO 4C 05.34 are generated on a computer and analyzed according to the rules of Bahcall and Goldsmith. The results conclusively show that the number and properties of the absorption redshift systems proposed by Bahcall Goldsmith are insignificantly different from those that would be expected from chance coincidences. (auth)

18103 A COMPARISON OF X—RAY SOURCES IN GLOBULAR CLUSTERS AND IN THE GALACTIC BULGE. Canizares, C.R. (Department of Physics and Center for Space Research, Massachusetts Institute of Technology). Astrophys. J. 201: No. 3, 589-592 (1 Nov 1975).

I suggest the hypothesis that the X-ray sources of the galactic bulge

and those in globular clusters are of the same type. This is supported by the similarity of the respective stellar populations and the observed incidence of luminous sources. Evolutionary considerations suggest that it is the high stellar density that favors X-ray source formation in those regions. If the correspondence is correct, there must be ~100 additional weak sources in the bulge which have so far eluded detection because of source confusion. (auth)

18104 B2 1101 + 38: A BL LACERTAE OBJECT. Miller, H.R. (Department of Physics, Georgia State University, Atlanta). Astrophys. J. Lett. 201: No. 3, L109-L111 (1 Nov 1975).

The archive plate collection of the Harvard College Observatory has been searched to determine the long-term optical behavior of the radio source B2 1101+38. B2 1101+38 was found to be a large-amplitude, rapid variable with a total range of $\geq$4.7 mag. This is the largest range observed for any BL Lacertae object. (auth)

18105 THE LIGHT CURVE OF A TRANSIENT X—RAY SOURCE. Kaluzienski, L.J. (University of Maryland, College Park); Holt, S.S.; Boldt, E.A.; Serlemitsos, P.J.; Eadie, G.; Pounds, K.A.; Ricketts, M.J.; Watson, M. Astrophys. J. Lett. 201: No. 3, L121-L124 (1 Nov 1975).

The *Ariel*-5 satellite has monitored the X-ray light curve of A1524-62 almost continuously from 40 days prior to maximum light until its disappearance below the effective experimental sensitivity. The source exhibited maximum light on ~ 1974 December 4, at a level of 0.9 the apparent magnitude of the Crab Nebula in the energy band 3–6 keV. Although similar to previously reported transient source with a decay time constant of ~2 months, the source exhibited an extended, variable preflare ON-state of ~ 1 month at a level of $\lesssim$ 0.1 maximum light. The four bright (>0.2 of the Crab Nebula) transient sources observed during the first half-year of *Ariel*-5 operation are indicative of a galactic disk distribution, a luminosity at maximum in excess of 10^{37} ergs s^{-1}, a frequency of occurrence which may be as high as 100 yr^{-1}, and a median decay time which is less than 1 month. (auth)

18106 THE LOCATION AND INTENSITY OF THE X—RAY SOURCE CENTAURUS A OBSERVED BY THE ASTRONOMICAL NETHERLANDS SATELLITE. Grindlay, J.E.; Schnopper, H.; Schreier, E.J.; Gursky, H. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory); Parsignault, D.R. Astrophys. J. Lett. 201: No. 3, L133-L136 (1 Nov 1975).

The HXX X-ray detectors on ANS have observed the source in NGC 5128, Cen A, with 10° collimators and high time resolution during 1975 January 26–29. A source position is obtained that is consistent with the nucleus of NGC 5128. No rapid source variability was detected, and limits on pulsations are given. The source brightness was a factor of 5.1±0.4 above the *Uhuru* value, although the spectral slope and low-energy cutoff were essentially unchanged. The source variability (1969–1975) is related to models for the nucleus of NGC 5128. (auth)

18107 POSSIBLE IDENTIFICATION OF A HIGH-LATITUDE X-RAY SOURCE WITH A QSO BY THE ASTRONOMICAL NETHERLANDS SATELLITE. Schreier, E.; Schnopper, H.; Gursky, H. (Center for Astrophysics, Harvard College Observatory/Smithsonian Astrophysical Observatory); Parsignault, D. Astrophys. J. Lett. 201: No. 3, L137-L139 (1 Nov 1975).

A recently discovered QSO, NAB 0137-01, located in proximity to the high galactic latitude X-ray source 3U 0138-01 was observed using the Hard X-ray Experiment on the Astronomical Netherlands Satellite. A flux of 0.33±0.14 counts s^{-1} (1.3–7.0 keV) was detected, consistent with the intensity of 3U 0138-01. The error box for the X-ray source is thus reduced to 0.02 square degrees, greatly increasing the likelihood that the association of the X-ray source with the QSO is not accidental. The intrinsic luminosity of the QSO is about 2×10^{46} ergs s^{-1}, with an X-ray to optical luminosity ratio of 50. (auth)

18108 ON THE LONG-TERM BEHAVIOR OF THE HZ HERCULIS/HERCULES X-1 SYSTEM. Anderson, L. (Astronomy Department, University of California, Berkeley). Astrophys. J. 202: No. 1, 232-237 (15 Nov 1975).

In accretion models for binary X-ray sources based on Roche-lobe overflow, mass transfer from an otherwise normal, expanding star to a collapsed companion is responsible for the production of X-rays. For a range of time-averaged rates of mass transfer, the instantaneous rate of transfer depends on the X-ray luminosity. Thus the rate may be subject to a feedback instability. We propose that such an instability is responsible for the long-period on-off behavior of HZ Herculis. (auth)

18109 INTENSE SOFT X—RAY FLUX FROM HERCULES X-1. Catura, R.C.; Acton, L.W. (Lockheed Palo Alto Research Laboratory). Astrophys. J. Lett. 202: No. 1, L5-L7 (15 Nov 1975).

An intense flux of soft X-rays extending up to at least 1 keV has been observed from Her X-1. If the soft X-ray intensity is corrected for interstellar absorption, the luminosity in the 0.16–0.28 keV band is comparable to that from 2 to 10 keV. This confirms the conclusion of Shulman *et al.* but extends the detection of this flux to higher energy, a different binary phase, and to a time 19 periods later in the 35-day cycle. These observations suggest that this soft emission may be a stable feature in the spectrum of Her X-1 during its X-ray ON state. It appears difficult to account for the high soft X-ray luminosity by current simple models of the X-ray source. (auth)

18110 MEASUREMENT OF THE SPATIAL STRUCTURE OF THE X—RAY SOURCE IN THE CRAB NEBULA. I. OBSERVATION OF THE 1974 NOVEMBER 3 LUNAR OCCULTATION. Wolff, R.S.; Kestenbaum, H.L.; Ku, W.; Novick, R. (Columbia Astrophysics Laboratory, Columbia University). Astrophys. J. Lett. 202: No. 1, L15-L19 (15 Nov 1975).

The 1974 November 3 (UT) lunar occultation of the Crab Nebula has been observed in the 1.5–17.5 keV X-ray range, at a position angle of 255°. The western portion of the nebula and the pulsar NP 0532 were seen in reappearance. Analysis of the data reveals that the western extent of the X-ray volume is approximately 48′ west of the pulsar. The centroid of the nonpulsed X-ray flux for the portion of the nebula observed is located about 20′ west of the pulsar, and the FWHM of the best-fitting Gaussian distribution is 42′±2′ in the observed energy range. (auth)

18111 MEASUREMENT OF THE SPATIAL STRUCTURE OF THE X—RAY SOURCE IN THE CRAB NEBULA. II. OBSERVATION OF THE 1974 DECEMBER 28 LUNAR OCCULTATION. Kestenbaum, H.L.; Ku, W.; Novick, R.; Wolff, R.S. (Columbia Astrophysics Laboratory, Columbia University, 538 W. 120th St., New York, NY 10027). Astrophys. J. Lett. 202: No. 1, L21-L24 (15 Nov 1975).

The 1974 December 28 (UT) lunar occultation of the Crab Nebula has been observed in the 0.6–23 keV X-ray range at a position angle of 300°. Reappearance of the region from 62′ west of the pulsar NP 0532 to 62′ east was observed. Analysis of the nonpulsed portion of the data reveals that the X-ray centroid is 12′.8±0′.3 west of the pulsar, averaged over the 0.6–23 keV range. The total width of the X-ray distribution has a mean value of 60′.5±1′.5 and decreases with increasing photon energy. (auth)

18112 PULSAR SLOW-DOWN AND THE TEMPORAL CHANGE OF G. Heintzmann, H. (Koeln Univ. (F. R. Germany). Inst. fuer Theoretische Physik); Hillebrandt, W. (Technische Univ. Darmstadt (F. R. Germany). Inst. fuer Kernphysik). Phys. Lett., A; 54: No. 5, 349-350(6 Oct 1975).

The pulsar JP 1953 has an abnormally small value of period change dP/dt. It is shown that such small dP/dt leads to an interesting upper limit on the time variation of the gravitational coupling strength dG/dt. For white dwarfs it is shown that abs. value $[(d/dt)\ln G] \simeq (\frac{1}{2})$ abs. value $[4-3\gamma](d/dt)\ln P \ll (\frac{1}{2}P)dP/dt \simeq 10^{-10}$ $years^{-1}$, whereas for typical neutron stars the limit is roughly an order of magnitude less stringent. (NL)

18113 COS-B EXPERIMENT FOR γ-RAY ASTRONOMY. Bignami, G. F.; Boella, G. (Consiglio Nazionale delle Ricerche, Milan (Italy)); Burger, J. J.; Taylor, B. G.; Wills, R. D. (European Space Research and Technology Centre, Noordwijk (Netherlands)); Keirle, P.; Paul, J. A. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service d'Electronique Physique); Mayer-Hasselwander, H. A.; Pfeffermann, E.; Voges, W. (Max-Planck-Institut fuer Physik und Astrophysik, Garching). Space Sci. Instrum.; 1: No. 3, 245-268(Aug 1975).

The COS-B satellite will carry a single large experiment, capable of detecting γ-rays with energies in excess of 20 MeV in order to study in detail the sources of extraterrestrial γ radiation. The principal objectives of the study will be to investigate the angular structure of γ-ray emission from the galactic plane, to measure the flux of the isotropic radiation from high galactic latitudes believed to be of extra-galactic origin, to examine known or postulated point sources of the radiation and to determine the energy spectra of all identified sources. (NL)

18114 UBV OBSERVATIONS OF 3C 273 VI. Burkhead, M. S.; Hill, R. K. (Univ. of Indiana, Bloomington). Publ. Astron. Soc. Pac.; 87: No. 519, 821(Oct 1975).

18115 UBV PHOTOMETRY OF STARS IN THE DIRECTION OF THREE LMC X-RAY SOURCES. Dufour, R. J. (Cerro Tololo Inter-American Observatory, La Serena, Chile); Duval, J. E. Publ. Astron. Soc. Pac.; 87: No. 519, 769-776(Oct 1975).

The results of UBV photometry of stars within or near the error boxes of LMC X-1, LMC X-2, and LMC X-3 are presented. The data on stars observed on several nights were analyzed for variability in their U, B, and V magnitudes. Suggestions are made concerning which stars around LMC X-1 and LMC X-3 are possibly variable and are promising candidates for the optical counterparts to these sources. (auth)

18116 OBSERVATION OF THE CYGNUS LOOP IN X-RAYS WITH A ONE-DIMENSIONAL FOCUSING COLLECTOR. Helava, H. I. Columbia, NY; Columbia Univ. (1975). 92p. University Microfilms Order No. 75-25,688.

Thesis (Ph. D.).

An x-ray telescope with about 6 arc minute resolution indicates that the optical, radio, and x-ray emissions of the Cygnus Loop are generally correlated. Correlation with optical emissions is not complete. The average temperature is 0.195 ± 0.03 kiloelectron volts with a hydrogen column density of $(0.07 \pm {}^{0.02}_{0.03}) \times 10^{22}$ atoms per square centimeter. The upper level on line emissions in a 0.3 to 2.0 kiloelectron volt bandwidth is established as 15 percent of the total emission. The x-rays at the eastern edge have a shell-like structure with thickness $15 \pm {}_{2}^{5}$ arc minutes. The upper limit on a stellar source at the center is established to be 4 percent of the total emissions in a 0.4 to 0.85 kiloelectron volt bandwidth at a 3-sigma level. (Diss. Abstr. Int., B)

18117 PHOTOGRAPHIC STUDIES OF QUASI-STELLAR OBJECTS AND OTHER ACTIVE RADIO SOURCES. Scott, R. L. Gainesville, FL; Univ. of Florida (1975). 376p. University Microfilms Order No. 75-23,915.

Thesis (Ph. D.).

Studies of the optical variability of a sample of 14 quasars and similar objects at Rosemary Hill Observatory detected statistically significant fluctuations in the light curves of PKS 0048-09, PKS 0420-01, PKS 0735+17, PKS 0736+01, PKS 0906-01, PKS 1510-08, and PKS 2349-01. Apparent color variations observed in a sample of QSO's at Rosemary Hill appear to be generally compatible with the expanding source model. However, 0J 287 and 3C 345 appear to be exceptions, as variations in their color indices suggest that changes in the slope of the optical spectrum may not be simply correlated with brightness. A spectral model composed of thermal and non-thermal components is offered as a possible explanation for the color variations observed in the objects studied. Studies of the lacertids PKS 1514-24, ON 231, and ON 325 suggest that the optical behavior of PKS 1514-24 and ON 231 is similar to that of the prototype lacertid BL Lac, while ON 325 shows more moderate short-term optical behavior superimposed on long-term fluctuations of several months' duration. A search for intraday activity in BL Lac detected statistically significant variations on two nights; the largest such variation was a decline of 0.6 m in 33 minutes. A search for an Io-related Jovian auroral hotspot has ended with essentially negative results. During the 1973 Jovian apparition, a total of 160 Jovian images was taken at Rosemary Hill in low-albedo ultraviolet and infrared regions. Visual examination and computer reductions revealed no trace of the hotspot. (Diss. Abstr. Int., B)

18118 COMPACT RADIO SOURCES. Altschuler, D. R. Waltham, MA; Brandeis Univ. (1975). 286p. University Microfilms Order No. 75-24,797.

Thesis (Ph. D.).

Eighty-seven compact radio sources were monitored between 1971 and 1974 with the National Radio Astronomy Observatory interferometer. Both flux density and polarization were measured at intervals of about one month at wavelengths of 3.7 and 11.1 cms. Forty-four sources showed definite variability in their total and/or polarized flux density. The variations in polarization were of a shorter time scale than the corresponding flux density variations. Some of the qualitative features of an expanding source model were observed. The data suggest that some form of injection of relativistic electrons is taking place. The absence of significant depolarization in the variable sources indicates that only a small fraction of the mass of the radio outburst is in the form of non-relativistic plasma. Some of the objects observed belong to the BL-Lacertal class. It is shown that this class is very inhomogeneous in its radio properties. For the violently variable BL-Lacertal type objects the spectrum, flux variations and polarization data strongly suggest that these are very young objects. (Diss. Abstr. Int., B)

18119 PROBLEMS ASSOCIATED WITH THE RAPIDLY VARYING COMPACT NONTHERMAL SOURCES. Burbidge, G. R.; Stein, W. A. (Univ. of California, San Diego). Comments Astrophys. Space Phys.; 6: No. 3, 87-94(1975).

The difficulties and possible interpretation of the observations of the compact nonthermal sources are explored. Flux variations, angular sizes, the radiation mechanism, and model calculations are discussed. (BJG)

18120 COPERNICUS: THE POSITION AND NATURE OF SCUTUM X-1. Charles, P. A.; Mason, K. O.; Davison, P. J. N. (University Coll., London). Astrophys. Lett.; 16: No. 4, 145-149(1975).

X-ray observations of Scutum X-1 by the Copernicus satellite have been combined with the published results of a rocket scan along the galactic plane to derive the position of the source. The most likely position is R. A. $18^h\ 35^m\ 1^s$, Dec $-07°\ 48'\ 00''$ (1950), and possible optical counterparts are suggested. The cut-off in the spectrum is equivalent to a column density of between 10^{23} and 10^{24} atoms cm^{-2}. Upper limits to the time variability of the source are computed. (auth)

18121 UPPER LIMIT OF THE LOW-ENERGY X-RAY FLUX FROM β PERSEI. Kifune, T.; Wolff, R. S.; Weisskopf, M. C. (Columbia Univ., New York). Astrophys. Lett.; 16: No. 4, 179-181(1975).

A region of the sky including the binary system Algol (β Persei) was observed with a one-dimensional, grazing-incidence x-ray telescope sensitive in the energy range from 0.5 to 4.0 keV. No statistically significant flux was detected above that attributable to the diffuse and cosmic-ray induced backgrounds. This result allows an upper limit of 2×10^{-11} ergs $(cm^2\ sec\ keV)^{-1}$ to be set at 1.6 keV to the x-ray emission from this source at the epoch of observation. It is concluded that the absence of detectable low-energy x-rays is consistent with a thermal radio source, on condition that no flares occurred at the time of observation. (auth)

Solar Phenomena

Refer also to abstracts 17219, 17939, 17984, 18020, 18024, 18073, 18271, 18283, and 18773.

18122 (COM-75-50193-365-1/SL) SOLAR-GEOPHYSICAL DATA NUMBER 365. Part I (Prompt Reports). Data for November 1974-December 1974. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Jan 1975. 115p. (SGD-365(Pt.1)). National Climatic Center, Asheville, NC $1.40.

Prompt reports are given on data for December 1974 and November 1974. These deal with alert periods, daily solar indices, solar flares, solar radio waves, spacecraft observations, solar x-ray radiation, solar proton monitoring, inferred IP magnetic field polarities, daily solar activity centers, sudden ionospheric disturbances, cosmic rays, geomagnetic indices, and radio propagation indices. (GRA)

18123 (COM-75-50193-365-2/SL) SOLAR-GEOPHYSICAL DATA NUMBER 365, JANUARY 1975. Part II (Comprehensive Reports). Data for June 1974-July 1974 and Miscellanea. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Jan 1975. 111p. (SGD-365(Pt. 2)). National Climatic Center, Asheville, NC $1.40.

Comprehensive reports are given on data for July 1974 and June 1974. These deal with solar flares, solar radio waves, magnetograms of geomagnetic storms, abbreviated calendar record, regional flare index, solar x-ray radiation, and solar radio waves. (GRA)

18124 (COM-75-50193-366-1/SL) SOLAR-GEOPHYSICAL DATA NUMBER 366. Part I (Prompt Reports). Data for December 1974-January 1975. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Feb 1975. 117p. (SGD-366(Pt.1)). National Climatic Center. Asheville, NC $1.40.

See also COM-75-50193-366-2.

Prompt reports are given on data for January 1975 and December 1974. These deal with alert periods, daily solar indices, solar flares, solar radio waves, solar wind measurements, spacecraft observations, solar x-ray radiation, solar proton monitoring, inferred IP magnetic field polarities, daily solar activity centers, sudden ionospheric disturbances, cosmic rays, geomagnetic indices, and radio propagation indices. (GRA)

18125 (COM-75-50193-366-2/SL) SOLAR-GEOPHYSICAL DATA NUMBER 366, FEBRUARY 1975. Part II (Comprehensive Reports). Data for July 1974-August 1974 and Miscellanea. Leighton, H. I. (National Geophysical and Solar-Terrestrial Data Center, Boulder, Colo. (USA)). Feb 1975. 39p. (SGD-366(Pt.2)). National Climatic Center, Asheville, NC $1.40.

See also COM-75-50193-366-1.

Comprehensive reports are given on data for August 1974 and July 1974. These deal with solar flares, solar radio waves, abbreviated calendar record, regional flare index, and cosmic ray indices. (GRA)

18126 SEARCH FOR PERIODIC VARIATIONS OF SOLAR RADIO EMISSION AT 3.7- AND 11.1-cm WAVELENGTHS. Kundu, M. R.; Alissandrakis, C. E. (Univ. of Maryland, College Park). Mon. Not. R. Astron. Soc.; 173: No. 1, 65-76(Oct 1975).

A search has been made for periodic time variations in the emission of quiet solar regions with the NRAO three-element interferometer at 3.7 and 11.1 cm. The visibility function of a source as obtained with a tracking interferometer is an implicit function of time, because of projected baseline changes, and therefore

only observations taken when the baseline changes vary slowly with time have been used. The visibility function shows significant time variations, but a power-spectrum analysis of the data revealed no unique periodicity. The estimated size of the time-varying elements is 2.5'' ± 0.2'' arc at 3.7 cm and 7.3'' ± 0.4'' arc at 11.1 cm. (auth)

18127 FINITE-AMPLITUDE CONVECTION IN A COMPRESSIBLE MEDIUM AND ITS APPLICATION TO SOLAR GRANULATION. Van der Borght, R. (Monash Univ., Clayton, Australia). Mon. Not. R. Astron. Soc.; 173: No. 1, 85-95(Oct 1975).

The results of an investigation in the theory of finite-amplitude convection in a compressible medium with polytropic structure are applied to the construction of a model of the solar granulation. A discussion is made of the various parameters involved in the problem and it is shown that a reasonable agreement can be reached between the theoretical predictions and the observed values. (auth)

18128 METHOD FOR ESTIMATION OF THE QUALITY OF THE SOLAR PROTON-EVENT FORECAST. Chen-hsing, T. (Peking Observatory). Tzu Tung Hua Hsueh Pao; 16: No. 1, 6-11(Jun 1975). (In Chinese).

The various indicators used to estimate the quality of the solar proton-event forecast are reviewed and their incompleteness is discussed. Introducing the concept of random forecast, the author proposes to adopt a combined indicator more reasonable for estimating the quality of the proton-event forecast. (JPRS)

18129 RELATION BETWEEN PROTON-FLARES AND MAGNETIC CONFIGURATIONS OF SUNSPOT GROUPS. Chung-hsien, S.; Yuan-chang, L.; Kuo-hsiang, A.; Chieh, C. S.; Jen-yang, C. (Peking Observatory). Tzu Tung Hua Hsueh Pao; 16: No. 1, 12-18(Jun 1975). (In Chinese).

The magnetic configurations of sunspot groups are separated into two classes, normal and abnormal. The normal class includes typical configurations of ordinary bipolar groups, in which spots are arranged nearly along the equator with preceding spots at lower latitudes, and their polarities conform to the well-known Hale's rule. The abnormal class includes δ-configuration, antipolarity, preceding spots at higher latitude and magnetic axis inclination greater than 30°. Study of the flare statistics in the period Oct. 1964 - Dec. 1972 of the 20th cycle shows that 85% of the proton flares occurred in sunspot groups which have abnormal configurations 1-3 days before. During the period of 1969-1970, the percentage of sunspot groups with abnormal configurations is about 14%. Although the A- and δ-configurations possess higher production rate, they have produced only 12% and 46% of proton flares, respectively. Thus, the separation of the abnormal configurations may be meaningful in view of the importance of forecasting and studying the mechanism of proton flares. (JPRS)

18130 LUMINOUS SHOCK WAVE AND EXPLOSIVE PHASE OF A CHROMOSPHERIC FLARE. Rumyantsev, A. A. Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 115-119(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 383-387(1975).

The propagation of a luminous shock wave in the solar atmosphere and the acceleration of charged particles at the shock front are analyzed. Electrons and protons whose initial energies are only slightly above the thermal energy become runaway particles in the electric field of the wave. The electrons acquire an energy ~30-100 keV. (auth)

18131 PLASMA THEORY FOR THE FORMATION OF A RADAR SIGNAL REFLECTED FROM THE SUN AND THE SOLAR-WIND PROBLEM. Gordon, I. M.; Gerasimova, N. N. Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 77-80(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 334-339(1975).

Results obtained in radar studies of the sun are discussed and the resulting conclusions of importance for the solar-wind problem are presented. (auth)

18132 PLASMA-ION VELOCITY DISTRIBUTION AND SOLAR NEUTRINOS. Vasil'ev, S. S.; Kocharov, G. E.; Levkovskii, A. A. (Ioffe Inst. of Physics and Tech., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 58-62(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 310-315(1975).

The expected flux of solar neutrinos can be reduced significantly when there are fewer ions in the high-energy part of the ion velocity distribution than in a Maxwell distribution. The total number of ions involved is on the order of 1% of the total number of particles in the solar plasma. With a high ^{3}He abundance beneath the convective shell it is possible to explain both the secular increase in the ^{3}He/^{4}He ratio and the anomalously large ^{3}He/^{4}He ratio in the corpuscular fluxes from several solar flares. (auth)

18133 DIFFICULTIES IN INTERPRETING SOLAR NEUTRINO EXPERIMENTS. Vasil'ev, S. S. (Ioffe Inst. of Physics and Tech., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 53-57(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 304-309(1975).

Certain hypotheses advanced in recent years to explain the negative results of experimental attempts to detect solar neutrinos are examined critically. Particular attention is paid to the hypotheses based explicitly or implicitly on the assumption that the sun is not a standard main-sequence star. (auth)

18134 PRODUCTION OF HYDROGEN AND HELIUM ISOTOPES AND γ-RAYS IN SOLAR FLARES. Ibragimov, I. A.; Kocharov, G. E. (Ioffe Inst. of Physics and Tech., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 38-52(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 287-303(1975).

The theory of nuclear reactions in solar flares is discussed. The yields of secondary ^{2}H, ^{3}H, and ^{3}He nuclei at low energies are calculated. It is suggested that there is a large amount of ^{3}He in certain flares. It is shown that the excess ^{3}H in lunar soil could have resulted from nuclear reactions in flares. The role played by ^{3}He in neutron capture at the sun is taken into account. The dynamics of the formation of the 0.51-MeV γ-line is analyzed in detail. (auth)

18135 POLARIZATION OF SOLAR-FLARE X-RADIATION. Korchak, A. A. (Inst. of Terrestrial Magnetism, the Ionosphere, and Radio-Wave Propagation, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 33-37(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 281-286(1975).

The limited information available from observations of the polarization of solar X-ray bursts in the energy range 12-20 keV cannot yet be interpreted in an unambiguous manner on the basis of the existing theoretical ideas. Complications result from the large uncertainty in the experimental data, the difficulty in taking into account the thermal component in this energy range, and the general transient nature of the processes occurring during flares. (auth)

18136 RADIAL DEPENDENCE OF ELECTRON TEMPERATURE AT HELIOCENTRIC DISTANCES OF 1 TO 1.5 ABSOLUTE UNITS FROM DATA OF MEASUREMENTS ON SPACESHIP MARS-3. Gringauz, K. I.; Verigin, M. I. (Inst. of Cosmic Research, Moscow). Dokl. Akad. Nauk SSSR; 223: No. 3, 589-592 (21 Jul 1975). (In Russian).

In order to select a model which best fits the actual properties of the solar wind, direct measurements of the solar wind are required at various heliocentric distances. It was found that the data best fit the following empirical formula: $T_e(r)$, 10^3°K = ~120 $(R_\odot/r)^{0.5}$. Here $R_\odot$ = 1 abs. unit = 150 × 10^6 km. Data from other spaceships gave the following relations for $T_e(R_\odot)$: ~140 × 10^3°K for Vela-4 (May 1967 to May 1968); ~155 × 10^3°K for OGO-5 (March 1968); and ~133 × 10^3°K for IMP-6 (March-June 1971). Discussions are presented on a two-liquid model of the solar wind. (SJR)

18137 γ-BURSTS OBSERVED ON THE PROGNOZ-2 SATELLITE DURING THE FLARES OF 4 AND 7 VIII 1972. Vedrenne, G.; Likin, O. B.; Melioranskii, A. S.; Pisarenko, N. F.; Savenko, I. A.; Talon, R.; Shamolin, V. M. (Inst. of Cosmic Studies, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 26-32(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 272-280(1975).

The apparatus for detecting solar X-rays and γ-rays carried on the Prognoz-2 satellite detected γ-bursts in association with flares on 4 and 7 VIII 1972. The results agree satisfactorily with a model for the flare event. (auth)

18138 PRODUCTION OF PROTONS, NEUTRONS, AND ELECTRONS AT THE SUN. Baisakalova, A. B.; Bogdanova, O. A.; Iskakov, T. Z.; Kobzev, V. A.; Kolomeets, E. V.; Kupchishin, A. I. (Kirov Kazakh State Univ., USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 20-25(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 264-271(1975).

Experimental data are used to show that at energies from 30 MeV downward there is a constant production of electrons, protons, and nuclei with Z ≥ 2 at the sun. It is argued that the observed particle flux is not of galactic origin. A calculation of the

constant neutron flux due to galactic cosmic rays is reported. The total and differential fluxes of solar neutrons are calculated as functions of the solar activity. (auth)

18139 NEUTRONS OF SOLAR ORIGIN. Dubinskii, Yu.; Efimov, Yu. E.; Kudela, K. (Ioffe Inst. of Physics and Tech., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 16-19 (1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 259-263(1975).

The current state of the problem of solar neutrons is examined. The need for further studies of solar neutrons is pointed out, and some ideas regarding these studies are offered. (auth)

18140 NUCLEAR COMPOSITION OF ENERGETIC SOLAR PARTICLES: A NEW SOURCE OF INFORMATION ON SOLAR FLARES. Lutsenko, V. N. (Inst. of Cosmic Studies, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 8-15(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 250-258(1975).

Experimental data on the chemical and isotopic composition of the energetic solar particles are reviewed. The nuclear composition of these particles represents a new source of information about solar flares and the physical conditions under which particles are accelerated at the sun. (auth)

18141 SOME QUESTIONS OF THE PHYSICS AND ASTROPHYSICS OF THE SUN. Kocharov, G. E. (Ioffe Inst. of Physics and Tech., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 3-7(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 244-249(1975).

Experimental data on solar neutrons, γ-rays, hydrogen isotopes, and ^{3}He and on the energetics of solar flares are interpreted. (auth)

18142 COSMIC-RAY VARIATIONS AND THE SOLAR WIND. Vernov, S. N.; Tverskoi, B. A.; Lyubimov, G. P.; Pereslegina, N. V.; Kontor, N. N.; Chuchkov, E. A. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 81-88(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 340-349(1975).

A hypothesis in which the active regions on the sun are identified as the source of quasi-steady plasma flows is developed on the basis of a study of the variations in the cosmic-ray intensity and a comparison of these variations with properties of the active regions and data on the velocity and density of the magnetized interplanetary plasma. (auth)

18143 CHARGED-PARTICLE ACCELERATION IN PROCESSES OF THE SOLAR-FLARE TYPE. Syrovatskii, S. I. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 96-108(1975).

Translated form Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 359-374(1975).

The production and decay of a neutral current sheet near a magnetic null line in a plasma are analyzed. There is a discussion of the conditions under which this neutral sheet breaks up and charged particles are accelerated to high energies. A comparison is made of the two basic models for plasma flow along a null line: a neutral sheet and a system of Petschek shock waves. (auth)

18144 THE SPATIAL AND TEMPERATURE STRUCTURE OF VACUUM SPARK PLASMAS. Feldman, U. (E. O. Hulburt Center for Space Research, Naval Research Laboratory); Goldsmith, S.; Schwob, J.L.; Doschek, G.A. Astrophys. J. 201: No. 1, 225-237 (1 Oct 1975).

The spatial and temperature structures of the X-ray emitting components of low-inductance vacuum spark plasmas are investigated. The plasmas produced by low-inductance vacuum sparks show striking resemblances to solar flare plasmas. High-resolution photographs show that the spark plasmas are composed of hot ($\sim 30\times10^6$ K) compact sources (<20 μ) and cooler ($\sim 10\times10^6$ K) larger sources (~ 100 μ). Both types of sources may be produced by the same plasma at different times. The differences between the solar flare iron-line spectrum near 1.9 A and the spark iron-line spectrum are discussed and interpreted. (auth)

18145 MULTIFREQUENCY TECHNIQUES FOR STUDYING INTERPLANETARY SCINTILLATIONS. Woo, R. (Jet Propulsion Laboratory, California Institute of Technology). Astrophys. J. 201: No. 1, 238-248 (1 Oct 1975).

Rytov's approximation or the method of smooth perturbations is utilized to derive the temporal frequency spectra of the amplitude and phase fluctuations of multifrequency plane and spherical waves propagating in the interplanetary medium and solar corona. It is shown that multifrequency observations of interplanetary scintillations using either compact radio stars or spacecraft radio signals are desirable because the correlation of the multifrequency waves yields additional independent measurements of the solar wind and turbulence. Measurements of phase fluctuations are also desirable because, unlike amplitude fluctuations, they provide information on the full range of scale sizes for the electron density fluctuations. We show that a coherent dual-frequency radio system is particularly useful in making such measurements. In addition to providing a means for interpreting observations of multifrequency interplanetary scintillations, the analysis in this paper is also essential for estimating the effects of solar corona turbulence on the communications and navigation of a spacecraft whose line-of-sight path passes close to the Sun. (auth)

18146 SOLAR MODELS OF LOW NEUTRINO-COUNTING RATE: THE CENTRAL BLACK HOLE. Clayton, D.D.; Newman, M.J.; Talbot, R.J. Jr. (Department of Space Physics and Astronomy, Rice University). Astrophys. J. 201: No. 2, 489-493 (15 Oct 1975).

Partial evolutionary sequences have been calculated for several solar models with central black holes of order 10^{-5} $M_\odot$. If these are assumed to radiate their Eddington limiting luminosity, the central temperature is depressed to the extent that the predicted count rate for the ^{37}Cl solar neutrino experiment nears the current upper limit of 1 SNU; this occurs when the auxiliary energy source provides about half of the solar luminosity. Count rates below this limit would result from an even larger black-hole luminosity. Consequences for stellar evolution of the occasional presence of black holes inside normal stars are discussed. (auth)

18147 X-RAY BRIGHT SPOTS ON THE SUN AND THE NONEQUILIBRIUM OF A TWISTED FLUX ROPE IN A STRATIFIED ATMOSPHERE. Parker, E.N. (Department of Physics, Department of Astronomy and Astrophysics, University of Chicago). Astrophys. J. 201: No. 2, 494-501 (15 Oct 1975).

The calculations are concerned with the hydrostatic equilibrium of a magnetic flux tube whose two ends are anchored at some level in a stratified atmosphere. It is shown that no hydrostatic equilibrium exists if the whole flux tube is twisted more than a modest amount, equivalent to a 45° pitch over only one scale height. When the total twisting exceeds this small amount, the tube is subject to negative tension (compression) and buckles, spirals, and/or lengthens into a contorted form which causes rapid dissipation and reconnection of the magnetic field. The rapid dissipation continues until the excess azimuthal field is consumed and equilibrium is again possible. We suggest that the magnetic flux tubes in the Sun generally have more than the allowed twisting, so that, when they rise up through the surface, as a consequence of their buoyancy, they are subject to rapid dissipation, causing the phenomenon observed as the X-ray bright spot. (auth)

18148 SOLAR ACTIVITY AND THE GENERAL ABSENCE OF HYDROSTATIC EQUILIBRIUM IN AN AZIMUTHAL MAGNETIC FIELD. Parker, E.N. (Department of Physics, Department of Astronomy and Astrophysics, University of Chicago). Astrophys. J. 201: No. 2, 502-508 (15 Oct 1975).

It is shown that any temperature variation along the axis of symmetry of an azimuthal field causes continual convective activity. There is no static equilibrium configuration, except in very special, and hence improbable, cases. We suggest that this dynamical effect contributes to the activity associated with the flux tubes extending through the solar photosphere. The X-ray bright spots, evidently caused by the emergence and expansion of small bipolar regions, may be produced in part by the convective effect of an azimuthal field. (auth)

18149 CRITERIA FOR PLASMA-WAVE LOSSES FOR ELECTRONS STREAMING FROM AN ACCELERATION REGION. Smith, D.F. (High Altitude Observatory, National Center for Atmospheric Research). Astrophys. J. 201: No. 2, 521-525 (15 Oct 1975).

Consistent criteria for determining when losses due to collective excitation of electron plasma waves will be important for electrons streaming from an acceleration region are derived. The analysis is nonrelativistic and one-dimensional, but includes the effect of Coulomb collisions. These criteria are applied to source models for solar hard X-ray bursts, and it is shown that these losses will almost never be important for the observations obtained thus far. The case in which the acceleration region and the X-ray source partially overlap is considered briefly. (auth)

18150 ENRICHMENT OF HEAVY NUCLEI IN ^{3}He-RICH FLARES. Hurford, G.J.; Mewaldt, R.A.; Stone, E.C.; Vogt, R.E. (California Institute of Technology). Astrophys. J. Lett. 201: No. 2, L95-L97 (15 Oct 1975).

Five ^{3}He-rich solar-flare particle events were observed in 1973–1974 with ^{3}He/^{4}He ranging from 0.2 to ~8 at 2.9–12.7 MeV per nucleon. In all five events the $(Z\geq6)/^1$H ratio at ~3 MeV per nucleon was enriched by ~10 to ~100 times and the $(Z\geq6)/^4$He ratio was enriched by ~3 to ~30 times, when compared with average solar-particle abundances measured over this 2-year period. It is suggested that the simultaneous enhancement of $Z\geq6$ and ^{3}He nuclei and the absence of ^{2}H and ^{3}H may be partly due to a preferential acceleration process which depends on the Z^2/A of the nuclei. (auth)

18151 ON NON-LTE H_2 + AS MISSING SOLAR OPACITY. Tarafdar, S.P. (Department of Applied Mathematics and Astronomy, University College, Cardiff, U.K.); Vardya, M.S. Astrophys. J. Lett. 201: No. 2, L99-L102 (15 Oct 1975).

A careful examination has revealed that use of incomplete reaction processes and incorrect rates has lead Krishna Swamy and Stecher to overestimate the H_2^+ opacity by a factor of 10^4 at λ=2000 Å. H_2^+ is not a significant source of opacity in the solar atmosphere. (auth)

18152 SPATIAL DISTRIBUTION OF XUV EMISSION IN SOLAR FLARES. Cheng, C.; Widing, K.G. (Naval Research Laboratory). Astrophys. J. 201: No. 3, 735-739 (1 Nov 1975).

The spatial distribution and time evolution of flare plasmas are studied with observations obtained with the NRL XUV spectroheliograph aboard *Skylab*. The hot 10–20 million degree plasma (Fe XXIII-XVIV) is located at the position of a gap in emission of the cooler plasmas (He II to Fe XIV-XVI) which often take the form of two ribbons. As the flare cools, the Fe XXIII-XXIV plasma disappears and the region between the two ribbons is filled gradually with emissions from lower stage ions. Comparison between spectroheliograms and magnetograms shows that the basic magnetic field configuration associated with the flares observed is a low-lying (4000 to 13,000 km) loop or arch structure. The flare apparently results from a plasma instability in the loop which produces localized heating in a small volume, usually near the top of the loop. Geometrical and physical properties of the hot flare plasma are presented, and implications of the observational results are briefly discussed. (auth)

18153 SOLAR-CYCLE DYNAMO WAVE PROPAGATION. Yoshimura, H. (Hale Observatories, Carnegie Institution of Washington, California Institute of Technology). Astrophys. J. 201: No. 3, 740-748 (1 Nov 1975).

Dynamo waves, as solutions of the dynamo equations governing the solar cycle, propagate along isorotation surfaces inside the Sun. This theorem, universal in most of the dynamo models of the solar cycle, is proven analytically, and the nature of the propagation is analyzed. The effects of meridional circulation and the diffusion process on the propagation nature of the dynamo waves are estimated. The importance of this theorem is stressed for understanding the solar cycle and for inferring the rotational law of the interior of the Sun. (auth)

18154 SOLAR WIND ELECTRONS. Feldman, W.C.; Asbridge, J.R.; Bame, S.J.; Montgomery, M.D.; Gary, S.P. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87544). J. Geophys. Res. 80: No. 31, 4181-4196 (1 Nov 1975).

Average characteristics of solar wind electron velocity distributions as well as the range and nature of their variations are presented. The measured distributions are generally symmetric about the heat flux direction and are adequately parameterized by the superposition of a nearly bi-Maxwellian function which characterizes the low-energy electrons and a bi-Maxwellian function with characterizes a distinct, ubiquitous component of higher-energy electrons. An alternate self-consistent description of the higher-energy component is presented in terms of an unbound population of hot electrons with energy greater than some breakpoint energy of $\simeq$60 V. The largest-scale parameter variations appear to come most often in association with high-speed streams. The salient electron parameter variations associated with these structures are presented and discussed. The mechanism by which interplanetary electrons conduct heat is convection of the hot component relative to the bulk speed. Arguments are presented which favor the local regulation of the solar wind heat flux at 1 AU. (auth)

18155 HEAT FLUX INSTABILITIES IN THE SOLAR WIND. Gary, S.P.; Feldman, W.C.; Forslund, D.W.; Montgomery, M.D. (University of California, Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87544). J. Geophys. Res. 80: No. 31, 4197-4203 (1 Nov 1975).

The linear dispersion properties of three electron heat flux plasma instabilities are studied in detail by using parameters appropriate to average values in the solar wind at 1 AU. Among the (fast) magnetosonic, Alfvén, and whistler instabilities the first one appears most likely to make a significant contribution to the regulation of the heat flux. (auth)

18156 RESONANCE-LINE TRANSFER WITH PARTIAL REDISTRIBUTION. VII. ANGLE-DEFENDENT REDISTRIBUTION. Milkey, R.W. (Kitt Peak National Observatory); Shine, R.A.; Mihalas, D. Astrophys. J. 202: No. 1, 250-258 (15 Nov 1975).

A method is presented for treating radiative transfer in resonance lines, allowing for the full angle and frequency dependence of redistribution in the scattering process, as seen in the laboratory frame. The case of an equivalent-two-level-atom source function is considered; the problem to be treated is then linear in the radiation field. We apply this method to the Ca II lines in the solar atmosphere, using a redistribution function which takes into account a mixture of coherence in the atom's frame, with Doppler redistribution in the laboratory frame (for atoms which have not suffered an elastic collision), and of complete redistribution in the laboratory frame (for atoms that are collisionally perturbed during the emission process). Both the angle-averaged approximation and the full angle-dependent solution were obtained, and were compared to assess, differentially, the effects of angular redistribution upon the computed line profile and its center-to-limb behavior. For the Ca II line in a homogeneous solar chromosphere the angle-dependent effects are found to be negligible, indicating that one may use angle-averaged redistribution functions when studying partial redistribution effects in line profiles. This result further validates our earlier work on the limb-darkening behavior of the solar and stellar Ca II lines. Angle-dependent effects may yet be important in situations where there is pronounced multidimensional structure (inhomogeneities) in the medium, or where velocity fields are present. (auth)

18157 A MODEL OF CORONAL HOLES. Adams, W.M.; Sturrock, P.A. (Institute for Plasma Research, Stanford University). Astrophys. J. 202: No. 1, 259-264 (15 Nov 1975).

It has been noted that coronal holes appear to be associated with regions of diverging magnetic field in the corona. We set out to test the hypothesis that coronal holes may be *caused* by an increased flow of energy into the solar wind resulting directly from this diverging magnetic field pattern. Simple models were devised to approximate the energy flow down into the transition region and up into the solar wind as a function of the temperature, density, and rate of field line divergence in the corona. By assuming the rate of mechanical energy influx into the corona to be constant, it was then possible to solve numerically for the coronal temperature and density as a function of the rate of field line divergence. The results of these calculations demonstrate that a diverging field pattern can, indeed, bring about reductions in the temperature and density at the base of the corona comparable to those observed in coronal holes. (auth)

18158 A NEW SOLAR CARBON ABUNDANCE BASED ON NON-LTE CN MOLECULAR SPECTRA. Mount, G. H.; Linsky, J. L. (Joint Institute for Laboratory Astrophysics, University of Colorado and National Bureau of Standards). Astrophys. J. Lett. 202: No. 1, L51-L54 (15 Nov 1975).

A detailed non-LTE analysis of solar CN spectra strongly suggests a revised carbon abundance for the Sun. We recommend a value of log $A_C = 8.35 \pm 0.15$ which is significantly lower than the presently accepted value of log $A_C = 8.55$. This revision may have important consequences in astrophysics. (auth)

18159 SOLAR PHOTOSPHERIC VELOCITY FIELD AND A NEW ANALYSIS OF THE FIVE MINUTE OSCILLATIONS. Lynch, D. K. Austin, TX; Univ. of Texas (1975). 213p. University Microfilms Order No. 75-24,906.

Thesis (Ph. D.).

Long time sequences of high spatial resolution velocity-grams (subtracted spectroheliograms) have been obtained in the Ca I lambda 6103 and Fe I lambda 6495 lines. By making use of the temporal regularity of the five minute oscillations, the slowly varying velocity field has been separated from the oscillatory component. The characteristic low frequency dominated power spectral density functions and the central peaked autocovariance functions are shown to owe their shape to the random aperiodic nature of the data. After correction for seeing and scanning, the mean diameter of the oscillating elements is 6.9 arc sec (5000 km) and the rms velocity fluctuation for the oscillating field is 0.42 km/sec. As in the case of the single velocitygrams, the 2.5 hour 30 sec time resolution movie was time wise manipulated to separate the slowly varying velocity field from the oscillatory velocity field. Separated full disk velocitygrams are quantitatively analyzed and show that the particle velocity of the oscillations is purely vertical. A broad discussion of the theoretical expectations of waves in the solar atmosphere is presented and observations are discussed with respect to the possible wave modes. A model of the oscillations is set forth which describes the oscillating velocity field as many independently oscillating acoustic elements which have a mean diameter of 5000 km. The physical basis of the oscillations is discussed. (Diss. Abstr. Int., B)

18160 MAGNETO-ACOUSTIC-GRAVITY WAVES. Hartunian, N. S. Waltham, MA; Brandeis Univ. (1975). 177p. University Microfilms Order No. 75-24,806.

Thesis (Ph. D.).

The application of magneto-acoustic-gravity waves (MAG) to the heating problem of the upper solar atmosphere is considered. The wave analysis is done in the WKB approximation which is appropriate only when lambda is much less than H (scale height). The procedure used was to start with the nonlinear one-fluid equation for an infinitely conducting fluid in a gravitational and magnetic field. Linearize this set, reduce the set to one equation with one unknown (the velocity), apply the WKB approximation, and obtain the dispersion relation. The dispersion relation factors into a second order algebraic equation, which is the magneto-acoustic-

gravity modes. This MAG dispersion relation is analyzed and three dimensional wave-vector surfaces are plotted for different frequency choices ranging from omega equals 0.3N up through omega equals 1.1N. In the Appendix, the special case studies by Ferraro and Plumpton (1958) of vertical gravitational and magnetic fields are considered. Their work of applying the WKB approximation only to the horizontal spatial direction and to time, by finding higher order terms in the power and asymptotic expansions appropriate for the system is extended. A method of using the asymptotic series as a step to finding a closed analytic solution to the special case of vertical magnetic and gravitational fields is suggested. (Diss. Abstr. Int., B)

18161 GASDYNAMIC MODEL OF SOLAR-WIND FLOW AROUND THE GEOMAGNETIC CAVITY. Erkayev, N. V.; Pivovarov, V. G. (Computer Center, Novosibirsk, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 921-922(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1095(1974).

A model of gasdynamic supersonic flow around a solid surface, simulating the surface of the magnetosphere, is examined. (BJG)

18162 TEMPORAL VARIATIONS OF SOLAR PARTICLE SPECTRA (AUGUST 4–7, 1972). Kremser, G. (Max-Planck-Institut fuer Aeronomie, Lindau, Ger.); Pfotzer, G.; Kirsch, E.; Specht, H.; Riedler, W.; Zirm, K. pp 603-607 of Correlated Interplanetary and Magnetospheric Observations. Dordrecht, Netherlands; D. Riedel Publishing Co. (1974).

From 7th ESLAB symposium; Saulgau, Germany (22 May 1973).

Solar particle fluxes were measured with baloon-borne instrumentation at Kiruna (Sweden) during the solar particle events of August 1972. Data from these balloon flights and from the satellite Explorer 41 were used to investigate the temporal variations of the energy spectrum during the event following the flare at 0620 UT on Aug. 4, 1972. It was found that the slope of the energy spectrum increased linearly in the latter part of the event. Extrapolation of these linear variations to the time of the flare yielded power-law differential energy spectra with an exponent gamma ranging from 1.8 to 2.3 or exponential rigidity spectra with a characteristic rigidity ranging from 85 to 110 MV. These values are in agreement with the corresponding parameters of time-integrated fluxes from Explorer 41. Implications of these results with regard to the source energy spectrum of the solar particles and their propagation in interplanetary space are discussed. (auth)

18163 SOLAR ACTIVITY AND THE SOLAR WIND. I. Eleven-Year Cycles. Hundhausen, A. J. (National Center for Atmospheric Research, Boulder, CO). Comments Astrophys. Space Phys.; 6: No. 3, 63-70(1975).

The apparent absence or weakness of the variations in solar wind properties with the eleven-year period of the sunspot cycle is discussed. (auth)

Galaxies

Refer also to abstracts 17950, 17951, 17957, 17977, 17979, 17986, 17989, 18004, 18029–18031, 18050, 18075, 18087, 18093, 18099, 18103, 18106, 18119, and 18249.

18164 OBSERVABLE EFFECTS OF DUST ON THE IONIZATION OF NEBULAE. Balick, B. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz). Astrophys. J. 201: No. 3, 705-718 (1 Nov 1975).

The effects of dust on the ionization and thermal structure of a photoionized nebula are explored by numerical model calculations. Particular emphasis is placed on the calculation of observable quantities such as the radio and infrared continua and the optical emission-line spectrum and the effects that dust might have on these quantities. The role of the dust in the nebular structure is summarized. Model calculations of planetary nebulae are shown to agree very well with much of the radio, infrared, and optical data. The importance of dust in the case of H II regions is called into question, especially as an explanation for the low abundance of ionized helium observed in several nebulae. (auth)

18165 4830 MHz H_2CO ABSORPTION IN THE DIRECTION OF NGC 6334. Gardner, F. F.; Whiteoak, J. B. (Commonwealth Scientific and Industrial Research Organization, Epping, Australia). Mon. Not. R. Astron. Soc.; 173: No. 1, 131-139(Oct 1975).

The distribution of 4830 MHz H_2CO absorption has been mapped over the northern radio component, G351.4 + 0.7, of NGC 6334. The absorption with an average velocity of -4 km s^{-1} has a general association with a dust lane extending across the H II region. In addition there are three H_2CO concentrations. Two coincide with OH-emission centers, one of which is an infrared source. The third, with the highest absorption and smallest angular extent, is centered on a compact continuum radio component; it is also an infrared source. (auth)

18166 WIDE SPECTRUM H_2O SOURCES: ASTROPHYSICAL RAMAN MASERS. Radhakrishnan, V.; Goss, W. M.; Rajendra Bhandari. (Raman Research Inst., Bangalore, India). Pramana; 5: No. 2, 49-58(Aug 1975).

The extraordinarily wide 22 GHz emission from W49A and two other galactic HII regions is discussed, and arguments presented why the entire width of these spectra cannot be attributed to the $6_{16} \rightarrow 5_{23}$ transition of H_2O. It is suggested that most of the weak emission with large frequency shifts is due to stimulated Raman scattering of the strong central features appearing at the expected frequency of the water vapor line. It was not possible to identify the scattering agent, but it is predicted that the spectra of millimeter-wave maser sources should also show such frequency-shifted features. (auth)

18167 THE STABILIZING EFFECTS OF CLOUD REACCELERATION; MICROTURBULENCE, AND ROTATION ON PARKER'S INSTABILITY. Zweibel, E.G.; Kulsrud, R.M. (Princeton University Observatory). Astrophys. J. 201: No. 1, 63-73 (1 Oct 1975).

We reconsider Parker's instability including a model equation of state for the gas of interstellar clouds, a tangled interstellar field, and galactic rotation. We find that for most choices of interstellar parameters consistent with observation the instability is stabilized. For the remaining choices which can lead to instability the growth time is longer than 10^8 years. Thus, we conclude the instability can have little to do with cosmic-ray escape and probably cannot destroy a primordial galactic field. (auth)

18168 COMMENT ON "THE STABILIZING EFFECTS OF CLOUD REACCELERATION, MICROTURBULENCE, AND ROTATION ON PARKER'S INSTABILITY". Parker, E.N. (Department of Physics, and Department of Astronomy and Astrophysics, University of Chicago). Astrophys. J. 201: No. 1, 74-75 (1 Oct 1975).

It is pointed out that the calculations in the paper by Zweibel and Kulsrud do not speak to the question of the instability and evolution of the gaseous disk of the Galaxy. Rather, they seem to treat the question of the statistical stability of the present turbulent dynamical state. (auth)

18169 MOLECULAR HYDROGEN IN THE GALAXY AND GALACTIC GAMMA RAYS. Stecker, F.W. (Theoretical Studies Group, NASA Goddard Space Flight Center, Greenbelt); Solomon, P.M.; Scoville, N.Z.; Ryter, C.E. Astrophys. J. 201: No. 1, 90-97 (1 Oct 1975).

Recent surveys of 2.6-cm CO emission and 100-MeV γ-radiation in the galactic plane reveal a striking correlation suggesting that both emissions may be primarily proportional to the line-of-sight column density of H_2 in the inner Galaxy. Both the γ-ray and CO data suggest a prominent ring or arm consisting of cool clouds of H_2 at a galactocentric distance of $\sim$ 5 kpc with a mean total hydrogen density equivalent to $\sim$5 atoms cm^{-3}. Estimates are made of column densities of H_2 at $^{II}=0°$. The estimates at 0° are compared with estimates from infrared and X-ray absorption measurements. These estimates are all consistent and indicate that H_2 is far more abundant than H I in the inner Galaxy and is the key to a more satisfactory explanation of the γ-ray observations than previous suggestions. The importance of H_2 in understanding galactic γ-ray observations is also reflected in the correlation of galactic latitude distribution of γ-rays and dense dust clouds. *The deduced cosmic-ray distribution inferred from the calculations is similar to that of galactic supernova remnants, suggesting a galactic origin for most cosmic rays.*

A detailed calculation of the γ-ray flux distribution in the 0°–180° longitude range using the CO data to obtain the average distribution of molecular clouds in the Galaxy shows that most of the enhancement in the inner Galaxy is due to π^0-decay radiation and the 5-kpc ring plays a major role. Detailed agreement with the γ-ray data is obtained with the additional inclusion of contributions from bremsstrahlung and Compton radiation of secondary electrons and Compton radiation from the intense radiation field near the galactic center. (auth)

18170 DISTRIBUTION OF NH_3 CLOUDS IN THE GALACTIC CENTER REGION. Kaifu, N. (National Radio Astronomy Observatory, Green Bank, West Virginia); Morris, M.; Palmer, P.; Zuckerman, B. Astrophys. J. 201: No. 1, 98-101 (1 Oct 1975).

The galactic center has been surveyed in three transitions of NH_3 along the galactic plane at $b = -2'$ in the longitude range $358° \leq l \leq 2°.3$. The velocity-longitude contour map of the (1,1) inversion transition shows a remarkably asymmetric distribution of dense molecular clouds with respect to the galactic center. Strong NH_3 sources are concentrated in the region of $0° \lesssim l \lesssim 2°$ and 0 km s$^{-1} \lesssim V_r \lesssim 100$ km s^{-1}. Also weak, extended features have been found in this region and in regions corresponding to the nuclear disk. The total mass of the dense

molecular clouds in the northern part of the galactic center region. ($0° \leq l \leq 2°$) is estimated to be $\lesssim 6 \times 10^7 M_\odot$. (auth)

18171 INTERSTELLAR HDCO: UPPER LIMIT AND SIGNIFICANCE AS AN INDICATOR OF INTERSTELLAR MOLECULE REACTIONS. Watson, W.D. (Departments of Physics and Astronomy, University of Illinois); Crutcher, R.M.; Dickel, J.R. Astrophys. J. 201: No. 1, 102-111 (1 Oct 1975).

Upper limits to the strength of the HDCO ($1_{11}-1_{10}$) transition at 5346 MHz are obtained from observations of Cas A, Cloud 4, NGC 2264, DR 21, Orion B, and Sgr B2. The observations are interpreted to yield an upper limit to the abundance ratio [HDCO]/[H_2CO] that is most likely about 1/170. We show that likely pure gas-phase processes (those employing CH_3+O and $CH_3^+ +O$) which have been proposed to form interstellar formaldehyde must also produce an enhanced [HDCO]/[H_2CO] ratio. Our observations indicate that the required enhancement probably does not occur. Formaldehyde is observed widely throughout the Galaxy and apparently requires a more complicated formation process than the simplest molecules. If gas reactions to produce formaldehyde cannot be found, it seems unlikely that the more complex interstellar molecules are produced purely by gas-phase reactions under the low temperature-density conditions where they are observed. (auth)

18172 CROSS SECTIONS FOR COLLISIONAL EXCITATION OF INTERSTELLAR FORMALDEHYDE. Evans, N.J. II (University of California, Berkeley). Astrophys. J. 201: No. 1, 112-117 (1 Oct 1975).

The cross sections for excitation of H_2CO in collisions with H_2 have been calculated in a quantum mechanical, close-coupling form. The Kohn variational method, adapted for multichannel scattering, was used to convert the system of coupled differential equations to a set of coupled algebraic equations. The effect of including close coupling is to increase the cross sections for excitation to the lower state of each doublet, relative to the cross sections for excitation to the upper state. This fact suggests that earlier quantum mechanical calculations differed from classical calculations because they neglected the coupling of states during the collision. These results lend credence to the collisional model for explaining the observations of anomalous absorption in H_2CO at 6-cm and 2-cm wavelengths. (auth)

18173 THE RADIO RECOMBINATION LINE SPECTRUM OF ORION A: OBSERVATIONS AND ANALYSIS. Lockman, F.J.; Brown, R.L. (National Radio Astronomy Observatory, Green Bank, West Virginia). Astrophys. J. 201: No. 1, 134-150 (1 Oct 1975).

We have considered the entire body of radio observations of Orion A, and examine how the temperature and density can be derived from the ratio T_L/T_C and the line width $\Delta\nu$ of the hydrogen radio recombination lines. Since it is critical to determine the extent to which low-frequency line measurements are contaminated by "baseline-subtraction" problems, we present new observations which, together with general considerations of the line shape and data reduction processes, support the following conclusions: (1) T_L/T_C and $\Delta\nu$ can be accurately determined in the low-frequency observations even when erroneous baselines are removed; (2) in accord with other studies, a density gradient must exist in the nebula; (3) isothermal models cannot reproduce the observed line strengths—the most dense parts of the nebula must be somewhat cooler than the surrounding gas. We have constructed a model of Orion A that is derived directly from the radio continuum observations. These observations demand that the simplest possible model of the nebula be comprised of three regions whose gross properties—the electrons density and the size—are defined by the continuum measurements. We have used this model for an analysis of the radio recombination line data, and we are able to reproduce virtually all known radio data on the Orion Nebula including (1) $\Delta\nu$ and T_L/T_C of the H $n\alpha$ lines from 610 MHz to 85 GHz; (2) $\Delta\nu$ and T_L/T_C of all the observed H $n\beta$ lines; (3) the shape and magnitude of the radio continuum spectrum. We also briefly consider the application of this model to the problem of the abundance and distribution of ionized helium with the nebula. (auth)

18174 INTERSTELLAR POLARIZATION: MAGNETITE DUST. Shapiro, P.R. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory). Astrophys. J. 201: No. 1, 151-164 (1 Oct 1975).

The polarization and extinction properties of magnetite, or Fe_3O_4, dust grains are calculated based on indirect evidence that magnetite grains might be the interstellar polarizers. The extinction and phase-lag cross sections of magnetite grains are calculated using a computer method for nonspherical grains. From these, the linear and circular polarization which would be produced by a medium of aligned magnetite dust grains is determined. It is found that flat platelets of magnetite can reproduce the wavelength dependence of the polarization observations. Furthermore, given the predictions by the Purcell "pinwheel" alignment mechanism of perfect alignment for such grains, it is shown that magnetite grains can produce all the observed polarization at the visual wavelength by consuming roughly 16 percent of the cosmic abundance of iron atoms in the interstellar medium, while contributing roughly 4 percent of the total visual extinction. With less than perfect alignment, more iron must be put into the magnetite grains, resulting in more magnetite extinction. A general property of interstellar polarization is also discussed based on the Kramers-Kronig dispersion relations. An infrared observational test of property is proposed. (auth)

18175 MULTIPLE ELECTRON EJECTION BY X—RAY PHOTOIONIZATION AND THE ABUNDANCE OF INTERSTELLAR IONS. Watson, W.D. (Departments of Physics and Astronomy, University of Illinois, Urbana); Kunz, A.B. Astrophys. J. 201: No. 1, 165-167 (1 Oct 1975).

Ejection of multiple electron due to "shake-off" and the double Auger processes is considered in photoionization by X-rays. Calculations using the sudden approximation are presented to support our estimates for multiple ejection in photoionization of nitrogen and oxygen. Multiple ejection is found to be much more probable for initially neutral atoms than for positive ions. Abundances for the various stages of ionization of N and O in the intercloud gas due to the observed X-ray flux are recalculated. The abundances of N V and O VI are increased by an order of magnitude for an electron density 0.02 cm^{-3}. (auth)

18176 IONIZED INTRACLUSTER GAS. Crane, P. (Joseph Henry Laboratories, Physics Department, Princeton University); Tyson, J.A. Astrophys. J. Lett. 201: No. 1, L1-L4 (1 Oct 1975).

Stringent upper limits for Hβ emission from ionized intergalactic gas are reported for four rich clusters of galaxies with a wide range of X-ray luminosities. For the clusters Abell 779, Abell 1367, Abell 1656 (Coma), and Abell 2199, the 2 σ limit gives $F(H\beta) \lesssim 2 \times 10^{-18}$ ergs s^{-1} cm^{-2} arcsec^{-2} and implies that it is unlikely that these clusters are bound by this type of gas at temperatures less than 2×10^6K. Combined with the X-ray results, these limits imply that it is unlikely that these clusters are bound by ionized gas at any temperature for $H_0=55$ km s^{-1} Mpc^{-1}. (auth)

18177 INTERSTELLAR MOLECULAR ABUNDANCES TOWARD OMICRON PERSEI. Snow, T.P. Jr. (Princeton University Observatory). Astrophys. J. Lett. 201: No. 1, L21-L24 (1 Oct 1975).

Extensive scanning of the B1 III star o Per ($V=3.79$, $E[B-V]=0.32$ mag) has been done with the *Copernicus* telescope-spectrometer in an effort to determine column densities or meaningful upper limits for several molecules expected to be relatively abundant in H I regions of moderate density. The combination of radio H I, OH, and CO emission-line data with the optical absorption measurements indicates that o Per is embedded in the near edge of a dense molecular cloud, and that the material seen in front of the star must be close to it. Molecules detected in ultraviolet absorption are H_2, HD, CO, and possibly OH. The CO rotational temperature is $2.2\ K \leq T_{rot} \leq 3.8\ K$. The observed column densities and upper limits from *Copernicus* and ground-based data are compared with recent models for molecular formation in diffuse clouds. (auth)

18178 CONFIRMATION OF INTERSTELLAR N_2H^+. Thaddeus, P. (Goddard Institute for Space Studies, New York City); Turner, B.E. Astrophys. J. Lett. 201: No. 1, L25-L26 (1 Oct 1975).

The identification of the new interstellar lines at 93.174 GHz as the molecular ion N_2H^+ has been confirmed by resolving in the source OMC-2 the predicted hyperfine structure of the inner nitrogen nucleus. The hyperfine constants of N_2H^+ derived from the observational data are eqQ (outer N) $=-5.666\pm0.012$ MHz, eqQ(inner N) $=-1.426\pm0.021$ MHz, and c (outer N) $=0.0147\pm0.0023$ MHz. The rest center frequency of the $J=1$–0 rotational transition is determined to be 93173.392 ± 0.031 MHz. (auth)

18179 THE NATURE OF HERBIG-HARO OBJECTS 1 AND 2: COMPACT EMISSION NEBULAE. Schmidt, G.D.; Vrba, F.J. (Steward Observatory, University of Arizona). Astrophys. J. Lett. 201: No. 1, L33-L35 (1 Oct 1975).

Optical polarization and infrared photometric observations have been obtained for Herbig-Haro objects 1 and 2. The results indicate that these objects are emission rather than the reflection nebulae predicted by the Strom interpretation of H—H objects. (auth)

18180 VELOCITY DISPERSIONS IN GALAXIES. IV. THE NUCLEUS OF NGC 1068. Richstone, D.O.; Morton, D.C. (Princeton University Observatory). Astrophys. J. 201: No. 2, 289-295 (15 Oct 1975).

The velocity dispersion of the stars in the nucleus of the Seyfert galaxy NGC 1068 was found to be 150 ± 50 km s^{-1} from an Fe I absorption line in a spectrum obtained with an integrating television sensor. If the structural length $R_0<140$ pc in the nucleus and $H=50$ km s^{-1} Mpc^{-1}, the mass within this radius is $14(+10, -8) \times 10^8 M_\odot$, and less if $R_0 \gtrsim 140$ pc. Strong interstellar H and K absorption lines superposed on the spectrum of NGC 1068 show that N (Ca II) $=(6\pm3) \times10^{12}$ cm^{-2} at $b=-52°$ in the halo of our galaxy. (auth)

18181 ON THE FORMATION OF ELLIPTICAL GALAXIES. Gott, J.R. III (California Institute of Technology). Astrophys. J. 201: No. 2, 296-310 (15 Oct 1975).

Simple collapse and violent relaxation models produce sharply cut off envelopes with $\rho(r) \propto r^{-4}$, whereas actual elliptical galaxies have more extended envelopes approximately given by $\rho(r) \propto r^{-3}$ as implied by Hubble's law. Numerical models are presented, showing that when cosmological infall effects are included, galaxies are produced with envelopes having a $\rho(r) \propto r^{-2.8}$ dependence in excellent agreement with Hubble's law. We have also computed a realistic rotating model of an *E*5 galaxy which includes infall effects and where the angular momentum of the galaxy is gained through tidal interactions with neighboring protogalaxies. The envelope displays a Hubble dependence but at great distances shows a cutoff due to the tidal effects. The model gives an outstandingly good fit to the envelope of the E5 galaxy NGC 4697. Except for simple scaling, this fit is produced without the use of any free-fitting parameters. A mass-to-light ratio for NGC 4697 is also computed. (auth)

18182 THE ROTATION CURVE AND GEOMETRY OF M31 AT LARGE GALACTOCENTRIC DISTANCES. Roberts, M.S. (National Radio Astronomy Observatory, Green Bank, West Virginia); Whitehurst, R.N. Astrophys. J. 201: No. 2, 327-346 (15 Oct 1975).

New 21-cm observations of the southern end of M31 indicate (1) that the plane of H I is bent away from the conventional plane by up to ~5 kpc and (2) that the rotational velocity is essentially constant over the outer 10 kpc, i.e., from 20 to 30 kpc radius. The latter implies a mass that increases linearly with R over this range and a mass-to-luminosity ratio of $\gtrsim 200$ for this outer region. At 30 kpc the surface density is $\sim 50\,M_\odot$ pc^{-2}. Dwarf M stars, the most common type of star in the solar vicinity, of number density of a few tenths pc^{-3} are adequate to explain the required mass and the mass-to-luminosity ratio. At these distances H I is ~ 1 percent of the total mass. (auth)

18183 SUSPECTED VV CEPHEI STARS IN THE LARGE MAGELLANIC CLOUD. Sanduleak, N.; Pesch, P. (Warner and Swasey Observatory, Case Western Reserve University). Astrophys. J. 201: No. 2, 347-349 (15 Oct 1975).

Twelve stars in the Large Magellanic Cloud show both hydrogen emission and TiO absorption features in the red and/or infrared. Five of these are known to be composite, apparently combining an M supergiant and a luminous blue component, and are probably VV Cephei stars. The remaining stars are suspected to be of a similar character. (auth)

18184 THE MOLECULAR CLOUD SAGITTARIUS B2. Scoville, N.Z. (Owens Valley Radio Observatory, California Institute of Technology); Solomon, P.M.; Penzias, A.A. Astrophys. J. 201: No. 2, 352-365 (15 Oct 1975).

The structure of the Sgr B2 molecular cloud has been studied by detailed and extensive mappings of the CO, ^{13}CO, CS, and H_2CO (2-cm) transitions. The cloud consists of a dense core at the OH maser position plus a very large envelope 45 pc across. Sagittarius B2 is one of the most massive objects in the Galaxy, containing about 3×10^6 $M_\odot$ an estimate arrived at independently from calculated ^{13}CO column densities, from application of the virial theorem, and from far-infrared measurements. The molecular gas has an average temperature T_k of ~20 K; that this is similar to the temperature of grains emitting far-infrared radiation is taken as evidence of near thermal equilibrium between dust grains and H_2. The dynamics of the gas in the cloud are found to be dominated by large-scale systematic motions with velocity not a monotonic function of radius. (auth)

18185 ROTATIONAL EXCITATION OF MOLECULAR IONS IN INTERSTELLAR CLOUDS. Green, S. (Department of Chemistry, Columbia University). Astrophys. J. 201: No. 2, 366-372 (15 Oct 1975).

Rate constants for rotational excitation of N_2H^+ by low-energy collisions with He have been obtained from accurate quantum mechanical calculations. Rates for excitation of HCO^+ and rates for excitation by collisions with H_2 are expected to be qualitatively similar. The excitation rate for molecular ions is found to be only slightly faster than that for similar neutral species, and not much faster as had been previously suggested. The implications of this for interpreting microwave observations of interstellar N_2H^+ and HCO^+ are discussed. (auth)

18186 A SEMIEMPIRICAL FORMULA FOR INTERSTELLAR BIREFRINGENCE. Martin, P.G. (David Dunlap Observatory and Scarborough College, University of Toronto). Astrophys. J. 201: No. 2, 373-376 (15 Oct 1975).

A formula for the wavelength dependence of interstellar birefringence is found by a semiempirical technique. This formula should facilitate the reduction and interpretation of observations of interstellar circular polarization, in the same manner in which Serkowski's formula is useful for linear polarization. (auth)

18187 IS DEUTERIUM OF COSMOLOGICAL OR OF GALACTIC ORIGIN? Ostriker, J.P. (Princeton University Observatory); Tinsley, B.M. Astrophys. J. Lett. 201: No. 2, L51-L54 (15 Oct 1975).

If deuterium is made primarily in stars, then according to current models of galactic evolution it should have a higher abundance in the metal-rich parts of the Galaxy. If it is produced only in the initial big bang, then astration causes a decrease in D abundance with increasing metal abundance z. Since the sign of the galactic metal abundance gradient is known ($dz/dr<0$), we propose that a determination of the sign of the deuterium abundance gradient would indicate the probable origin of this isotope. In particular it appears possible that the ratio of the radio recombination line strengths (D/H) from dense H II regions might be measurable with realizable equipment and determine, relatively unambiguously, the ratio of abundances in various parts of the Galaxy. (auth)

18188 THE DETECTION OF CARBON MONOXIDE EMISSION IN PLANETARY NEBULAE. Mufson, S.L.; Lyon, J. (National Radio Astronomy Observatory); Marionni, P.A. Astrophys. J. Lett. 201: No. 2, L85-L89 (15 Oct 1975).

We report the first detection of a molecule from planetary nebulae. We have found carbon monoxide emission in the planetary nebulae NGC 7027, IC 418, and NGC 6543. Compared with the optical nebula, the carbon monoxide emission about NGC 7027 is extended. We interpret our observations of NGC 7027 as a shell of gas ejected from the preplanetary nucleus as it evolved into a planetary. (auth)

18189 AN UNUSUAL NEBULA NEAR UOA 27. Kleinmann, S.G.; Lebofsky, M.J. (Physics Department and Center for Space Research, Massachusetts Institute of Technology). Astrophys. J. Lett. 201: No. 2, L91-L93 (15 Oct 1975).

New-infrared plates of a region in Cygnus show an extremely red nebula, ~25″ in diameter, which is displaced by 18″±6″ from UOA 27, an object with infrared and microwave properties similar to those of the Becklin-Neugebauer point source in Orion. We suggest that this nebula may be reflecting light from the same obscured star which is the energy source for UOA 27, and could therefore provide a unique, though indirect, means of inestigating the nature of stars which heat the BN point source and related objects. (auth)

18190 THE STRUCTURE OF THE OUTSKIRTS OF THE COMA CLUSTER. Rood, H.J. (Department of Astronomy and Astrophysics, Michigan State University). Astrophys. J. 201: No. 3, 551-555 (1 Nov 1975).

If the line-of-sight velocities of a large complete sample of galaxies brighter than a given apparent magnitude limit in a region of a cluster are known, then the number of field galaxies within $\pm3\sigma_v$ of the mean velocity of the cluster can be estimated statistically. The method is applied to samples of galaxies in an outer region of the Coma cluster. It is estimated that the outer radius extends beyond 5° (8 Mpc for H=75 km s^{-1} Mpc^{-1}). If the observed space number density distribution between R = 1°.7 and R = 5° is forced to fit the formula $\nu(r) \propto r^n$, where r is the distance of a point from the cluster center, then $n=-2.7\pm0.8$. However, the fit of the observational data to the formula is rather poor. (auth)

18191 H II REGIONS IN PECULIAR GALAXIES. Hodge, P.W. (University of Washington). Astrophys. J. 201: No. 3, 556-562 (1 Nov 1975).

A survey of 32 galaxies, either classified as peculiar or having peculiar distributions of H II regions, is presented in order to ascertain the range of the peculiarities and the degree to which they are similar. Ten different types are recognized, several of which are interrelated. They include distortions of spiral patterns, bright diffuse emission, filaments, central core features, and spiral-arm anomalies of various sorts, and are probably caused by either gravitational or explosive disturbances of the galaxies. (auth)

18192 AN ATTEMPT TO MEASURE THE METALLICITY OF GALAXIES FAR INTO THEIR HALOS. Spinrad, H. (Department of Astronomy, University of California, Berkeley); Stone, R.P.S. Astrophys. J. 201: No. 3, 563-565 (1 Nov 1975).

Attempts were made to extend photoelectric CN measures to large radial distances in three galaxies. Low surface brightnesses preclude very definite conclusions, but the E0 galaxy NGC 1399 appears to be metal-rich out to 20 kpc from its center, while the S0 galaxy NGC 1553 and the Sa galaxy NGC 7814 show a definite CN decrease to a likely extreme Population II level. Measurements of the CN strength were also made for several southern halo globular clusters of our Galaxy. (auth)

18193 RATE OF THE REACTION $N_2H^+ + CO \rightarrow HCO^+ + N_2$ AND ITS SIGNIFICANCE FOR THE INTERSTELLAR CHEMISTRY OF N_2H^+. Herbst, E. (Department of Chemistry, College of William and Mary in Virginia, Williamsburg, Virginia); Bohme, D.K.; Payzant, J.D.; Schiff, H.I. Astrophys. J. 201: No. 3, 603-606 (1 Nov 1975).

The rate constant for the reaction $N_2H^+ + CO \rightarrow HCO^+ + N_2$ has been determined to be $8.79\pm0.13\times10^{-10}$ cm^3 s^{-1} at 297±2 K with an estimated accuracy of ±25 percent. The implications of this rate constant for the interstellar chemistry of N_2H^+ are discussed. Estimates are made for the frequencies of the first rotational transitions in $^{15}N^{14}NH^+$, $^{14}N^{15}NH^+$, and N_2D^+. (auth)

18194 GALACTIC EVOLUTION. I. SINGLE-ZONE MODELS. Thuan, T.X. (Princeton University Observatory); Hart, M.H.; Ostriker, J.P. Astrophys. J. 201: No. 3, 756-772 (1 Nov 1975).

We calculate possible evolutionary histories for a cylindrical element (1 pc² cross section) perpendicular to the plane of the Galaxy including the Sun, under the following restrictive assumptions: (1) the total mass in the cylinder, which is constant in time, is initially gaseous and metal free; (2) the gaseous component is always well mixed; (3) the birthrates of various stellar types are declining (or increasing) exponential functions of time. Although this procedure allows a great variety of evolutionary paths, *no satisfactory model could be constructed* when it was required that the calculated models, after $\sim 12\times10^9$ years, match present observations in the solar neighborhood. The models either produced far too many metal-poor, low-mass stars, or had an increasing rate of low-mass star formation and were presently about to convert all the gas to low-mass stars, or they had both defects. No plausible variations of the input physics (stellar evolution theory, etc.) or boundary conditions (age of the Galaxy, etc.) could be found which would allow a satisfactory model to be made. After demonstrating the *failure* of one-zone galactic models, we suggest that an alternative scheme, to be explored in the next paper, in which material shed from dying halo stars makes a substantial contribution to mass, will solve or alleviate the problems described in the present investigation. (auth)

18195 A NEW MILKY WAY SATELLITE FOUND IN 21-CENTIMETER LINE OBSERVATIONS. Simonson, S.C. III (University of Maryland). Astrophys. J. Lett. 201: No. 3, L103-L108 (1 Nov 1975).

An anomalous feature in the 21-cm line observations has the characteristics of an external galaxy passing near the Milky Way. The galaxy's center is at $l = 197.^{\circ}3 \pm 0.^{\circ}5$, $b = +2.^{\circ}1 \pm 0.^{\circ}5$, and its angular size is $7^{\circ}\times2^{\circ}$. Tidal debris extends to $l=155^{\circ}$, $b=+8^{\circ}$, forming a stream of H I high-velocity clouds that crosses $l = 180^{\circ}$ at $V = -90$ km s^{-1}. The observations together with dynamical models of the tidal interaction using Schmidt's rotation parameters indicate a distance from the Sun of 17 ± 4 kpc, a perigalactic distance of 22 ± 2 kpc, and a mass of $1.0 \pm 0.2 \times 10^8\ M_{\odot}$. (auth)

18196 MICROWAVE DETECTION OF INTERSTELLAR CYANAMIDE. Turner, B.E. (National Radio Astronomy Observatory, Green Bank, West Virginia); Kislyakov, A.G.; Liszt, H.S.; Kaifu, N. Astrophys. J. Lett. 201: No. 3, L149-L152 (1 Nov 1975).

We report the detection of interstellar cyanamide (NH_2CH) based on the observation of line emission in Sgr B2 at 80504.5 and 100629.5 MHz corresponding to the transitions 4_{13}–3_{12} and 5_{14}–4_{13}. Statistical equilibrium calculations indicate a low column density ($\sim 10^{14}$ cm^{-2}) arising from a rather high density region ($\gtrsim 10^5$ cm^{-3}). (auth)

18197 POSSIBLE SPIRAL STRUCTURE IN THE ORION MOLECULAR CLOUD. Phillips, T.G. (Queen Mary College, University of London); Jefferts, K.B.; Huggins, P.J.; Ade, P.A.R.; Clegg, P.E. Astrophys. J. Lett. 201: No. 3, L157-L159 (1 Nov 1975).

Results are presented of extensive mapping of the Orion molecular cloud in the CO ($J=2-1$) line indicating the existence within the cloud of large-scale ordered structure of ring or spiral type. (auth)

18198 H I EARLY-TYPE GALAXIES. I. OBSERVATIONS. Gallagher, J.S. (University of Nebraska-Lincoln, and University of Minnesota, Minneapolis); Faber, S.M.; Balick, B. Astrophys. J. 202: No. 1, 7-21 (15 Nov 1975).

New 21-cm observations of 25 E and S0 galaxies provide a basis for an observational study of relationships between H I content and other properties of early-type systems. Only two galaxies in the sample, NGC 2685 (S0p) and the normal S0 NGC 5102, are detected. Previously reported detections of NGC 1332, NGC 3115, NGC 4274, and NGC 4526 are not confirmed. A very low limit of $M_{HI}/L_{pg} < 0.007$ is also measured for the Sombrero Galaxy, NGC 4594. By assuming that the undetected E's and S0's are representative of homogeneous populations, limits for mean E and S0 galaxies of $\langle M_{HI}/L_{pg}\rangle < 0.009$ and < 0.015, respectively, are found. All available H I observations of early-type galaxies are used to generate a list (containing four normal S0's and 12 peculiar galaxies) of high-probability detections. From these data and our new measurements, we conclude: 1. Elliptical galaxies contain at most 0.1 percent H I by mass. This is consistent with other observed features such as lack of internal reddening, dust lanes, and H II regions, all of which indicate that little interstellar matter is present. 2. Some structurally normal S0 galaxies exist with $M_{HI}/L_{pg} \gtrsim 0.05$, while other, apparently similar, systems have upper limits $M_{HI}/L_{pg} < 0.03$. In the available small sample of normal S0's, H I content does not correlate with the presence of dust lanes, optical emission or even blue colors. The most hydrogen-rich S0's have relative H I masses as large as those found for some normal Sb spirals. 3. In terms of H I content, the S0 class appears to be a true transition between the H I properties of spirals and ellipticals. The present data do not support the conclusions of earlier surveys which found the H I content of normal S0's to be anomalously large. 4. In some galaxies an extensive interstellar medium is obviously present, but has different properties from those usually found in later type spirals. For example, dust is present in NGC 4594 but no H I is detected, while NGC 5102 contains H I but no detectable dust. 5. Among the morphologically peculiar early-type galaxies, those which exhibit violent activity are rich in H I. In these galaxies, other signs of interstellar matter such as dust of young stars are often present. (auth)

18199 THE OVERALL DISTRIBUTION OF CARBON MONOXIDE IN THE PLANE OF THE GALAXY. Burton, W.B.; Gordon, M.A. (National Radio Astronomy Observatory, Green Bank, West Virginia); Bania, T.M.; Lockman, F.J. Astrophys. J. 202: No. 1, 30-49 (15 Nov 1975).

We observed the 2.6-mm line of ^{12}CO at 5° longitude intervals along the galactic equator between $l=10^{\circ}$ and 200° with a velocity coverage sufficient to include all velocities expected in terms of differential galactic rotation. CO emission is generally observed at positive velocities (LSR) at $l<60^{\circ}$ up to the sub-central region terminal velocity. The spectra show considerable structure characterized by relatively small velocity dispersions of about 2 km s^{-1} and antenna temperatures of 2 or 3 K. The characteristic appearance in the spectra of isolated features allowed us to make a rough estimate of the frequency of the occurrence of detected clumps of CO along the line of sight as 0.5 kpc^{-1}. The observations show that 60 percent of the CO emission observed originates between 4 and 8 kpc from the galactic center. At $R>8$ kpc and $R<4$ kpc the accumulated emission decreases rapidly. At directions and velocities corresponding to $R>R_0=10$ kpc, only a few isolated emission peaks are found, generally associated with known H II regions. Histograms of abundance as a function of R are given for the distributed CO and H I, and for giant H II regions. H II and CO show a rather similar large-scale distribution (although that of the H II is less regular); both are more concentrated than H I to the inner Galaxy as well as more concentrated than H I to the galactic plane. Similar morphological characteristics also distinguish the distribution of OH, supernova remnants, very young stars, pulsars, γ-radiation, and diffuse H II gas from that of the neutral hydrogen. The relative distributions are amenable to interpretation in terms of compression on a galactic scale associated with density-waves. (auth)

18200 A SURVEY OF CARBON MONOXIDE EMISSION IN DARK CLOUDS. Dickman, R.L. (Physics Department, Columbia University). Astrophys. J. 202: No. 1, 50-57 (15 Nov 1975).

Results are reported of a CO and ^{13}CO survey of 68 dark clouds from the Lynds catalog. CO was detected in 63 of the 64 sources in which it was searched for, and the ^{13}CO line was seen in 52 of 55 clouds. There is a rather narrow distribution of CO peak line radiation temperatures about a mean of $\sim$6 K; this may reflect the presence of a roughly uniform kinetic temperature of about a mean of $\sim$9.5 K in the sources. Despite the probably subthermal excitation temperature of the ^{13}CO transition observed, derived ^{13}CO column densities are most likely good to within a factor of 2. Typical CO column densities for the clouds surveyed are $N_{co}\simeq5\times10^{17}$ cm^{-2}, assuming a terrestrial carbon isotope ratio. All 68 clouds have previously been studied by Dieter in 6-cm H_2CO absorption; a comparison of line widths shows the ^{13}CO lines to generally be wider than their formaldehyde counterparts. Possible explanations of this fact in terms of internal cloud motions are discussed. (auth)

18201 MOLECULAR ALIGNMENT AND RADIATIVE TRANSPORT. Litvak, M.M. (Center for Astrophysics, Harvard College Observatory and Smithsonian Astrophysical Observatory). Astrophys. J. 202: No. 1, 58-75 (15 Nov 1975).

Methods and examples are given for the calculation of the unequal populations among magnetic sublevels of interstellar molecules subject to anisotropic and polarized radiation and to elastic and inelastic collisions among the rotational levels. Though as yet unobserved, the most likely source of such radiation that thereby aligns the molecules, such as HCN, is an adjacent layer in a slab or cylinder region that emits as a maser parallel to the layer. The molecular alignment is shown to affect the opacity, source function, and emergent flux, for example, in the hyperfine-split 3-mm HCN components. Polarization properties of masers are briefly discussed in this connection by means of transport equations for the normalized Stokes parameters. Propagation from maser regions into absorber regions can greatly change the polarization. (auth)

18202 THE 9.1-GHz CYANOACETYLENE LINE IN SAGITTARIUS B2. McGee, R.X.; Newton, L.M.; Butler, P.W. (Division of Radiophysics, CSIRO, Sydney, Australia). Astrophys. J. 202: No. 1, 76-80 (15 Nov 1975).

Improved observations of the $J=1-0$ emission line of cyanoacetylene combined with evidence from other molecular-line observations in Sgr B2 suggest the presence of four separate molecular clouds, close to and in front of the source, with radial velocities near +49.3, +60.5, +68.6, and +80.2 km s^{-1}. (auth)

18203 A STUDY OF THE COMPACT NEBULAE VV 8 AND M3−27. Adams, T.F. (Department of Astronomy and Astrophysics, University of Chicago). Astrophys. J. 202: No. 1, 114-120 (15 Nov 1975).

New photometric observations of the lines and continuum in the

compact nebulae VV 8 and M3−27 are presented. The data for VV 8 are very similar to those obtained by O'Dell nearly 10 years ago. Both nebulae have high electron densities and are self-absorbed in Hα. Parameters describing the physical conditions are estimated using the observed Balmer and [O III] line strengths. By comparing the observations with suitable models for young planetary nebulae, the abundances of helium, oxygen, and neon are shown to be normal. The [N II] lines are stronger than predicted. The continuum in M3-27 is shown to be in good agreement with theory, while the continuum in VV 8 in the visible and infrared is much brighter than predicted. The similarity between the line spectra and inferred properties of the nebulae suggests that the optical continuum in VV 8 is unrelated to the nebula, and may come from a late-type companion in a binary. Serious difficulties remain, however, concerning the absolute magnitude and color of the companion in the binary model. Some implications of Zipoy's shell star model are also examined. (auth)

18204 MODELS OF PLANETARY NEBULAE WITH DUST. Ferch, R.L.; Salpeter, E.E. (Center for Radiophysics and Space Research, Cornell University). Astrophys. J. 202: No. 1, 195-203 (15 Nov 1975).

Computer models have been constructed of planetary nebulae of 0.15 and 0.5 $M_\odot$ total mass, containing varying amounts of absorbing dust grains. In all cases the dust remained well mixed with the gas, and was responsible for the maintenance of a well-defined inner edge for the nebular shell. Once the nebula was ionized, the expansion in the outer regions accelerated due to pressure gradients, so that the observed mass decreased with time. The more massive nebulae were found to expand more slowly. Even when all of the Lα radiation was absorbed by grains, it was not as important for grain heating and acceleration as the direct stellar radiation. Agreement with several aspects of recent infrared observations was obtained. (auth)

18205 FORMALDEHYDE IN THE RHO OPHIUCHI DARK CLOUD. Myers, P.C.; Ho, P.T.P. (Massachusetts Institute of Technology, Research Laboratory of Electronics and Department of Physics). Astrophys. J. Lett. 202: No. 1, L25-L30 (15 Nov 1975).

The 6-cm transition of H_2CO was mapped in absorption over a region $\sim 1^\circ \times \sim 1^\circ$ with 6′ resolution toward the ρ Oph dark cloud. The distribution of H_2CO column density agrees well with the extinction due to dust. At least three regions of high H_2CO concentration can be identified. Two regions of reduced H_2CO column density coincide with regions of carbon recombination-line emission, reflection nebulosity, and concentration of infrared sources. The most likely mechanisms of line intensity reduction are increased excitation temperature, due to electron collisions, and reduced column density, due to destructive C^+ collisions. Both effects are associated with the observed C II regions (s). A north-south velocity gradient of ~ 0.5 km s^{-1} pc^{-1} is observed, which is probably not sufficient to stabilize the cloud against large-scale gravitational collapse. (auth)

18206 DETECTION OF THE [O III] 88.16 MICRON LINE IN M17. Ward, D.B.; Dennison, B.; Gull, G.; Harwit, M. (Center for Radiophysics and Space Research, Cornell University). Astrophys. J. Lett. 202: No. 1, L31-L32 (15 Nov 1975).

The [O III] 88.16 μ line has been detected in the galactic H II region M17. The line intensity is 2.2 $(+1.0, -0.7) \times 10^{-15}$ W cm^{-2}. (auth)

18207 8–13 MICRON MAPS OF THE TRAPEZIUM REGION OF THE ORION NEBULA. Gehrz, R.D.; Hackwell, J.A.; Smith, J.R. (Department of Physics and Astronomy, The University of Wyoming). Astrophys. J. Lett. 202: No. 1, L33-L36 (15 Nov 1975).

The Trapezium region of the Orion Nebula has been mapped at 8.6, 10.1, 11.2, 12.2, and 13.1 μ with an infrared array spectrometer. The 8–13 μ spectral structure of the entire region is characterized by emission and absorption by silicate grains. The grain emission is most prominent in the vicinity of the Trapezium. Absorption by silicate grains is evident only in the Becklin-Neugebauer–Kleinmann-Low region. It is concluded that the most likely grain heating mechanism in the Ney-Allen sources is the absorption by the grains of Lα radiation resonantly trapped within the H II region. (auth)

18208 OSCILLATOR STRENGTH FOR THE $D\ ^2\Sigma^- - X\ ^2\Pi$ TRANSITION IN OH. Ray, S.; Kelly, H.P. (Department of Physics, University of Virginia, Charlottesville). Astrophys. J. Lett. 202: No. 1, L57-L58 (15 Nov 1975).

The oscillator strength f (0,0) for the $D^2\ \Sigma^- - X\ ^2\Pi$ transition in OH has been calculated by use of the multiconfiguration Hartree–Fock program of Das and Wahl. Our length and velocity results are 0.00356 and 0.00369, respectively. These oscillator strengths bring the OH abundance results as determined by the *Copernicus* satellite into better agreement with the lowest limit measured by Knapp and Kerr for the general interstellar medium. (auth)

18209 LINEAR POLARIZATION OF RADIO GALAXIES AND QUASARS. Vallee, J. P. Toronto; Univ. of Toronto (1973). vp. National Library of Canada, Ottawa.

Thesis (Ph. D.).

A study of the linear polarization of radio galaxies and quasars was made for the wavelength range between 1 and 22 centimeters. The purposes of this study were: To add significantly to the knowledge of the linear polarization of extragalactic radio sources by making observations at wavelengths shorter than 6 centimeters. To obtain a sufficiently accurate understanding of the effects of a magnetic field in the local spiral arm, in order to be able to remove the contribution of the Galaxy on the observed radio emission from radio sources. To investigate the possibility of a similar contribution from an intergalactic magnetic field in an expanding universe. To analyse the intrinsic polarization properties of galaxies and quasars, as well as other source properties. The observations of linear polarization were made using the 46-meter radio telescope located at the Algonquin Radio Observatory. Combining these observations with other ones, as published in the literature in the wavelength range between 1 and 22 centimeters, it was possible to almost double the number of sources with observed rotation measures and having a "normal" spectrum. An investigation of the possible existence of an intergalactic magnetic field has been carried out in two opposite ways. One way was to assume a smooth distribution of matter in the observable universe, and led to negative results. The second way was to assume a clumpy distribution of matter in the form of (and surrounding the) radio galaxies and quasars. It led to an apparent contribution to the intrinsic rotation measures, but only extragalactic radio sources with small redshift values would show a possible effect. The statistical results of correlating two by two a total of 68 properties for 252 different extragalactic radio sources are presented. Besides the few well-known correlations between source properties, a few new ones have been found. They deal with the mass of ionized gas in radio galaxies and quasars, and with the optical spectral index of radio emitting quasars. An analysis showed that the brightness temperature (in the frame of a radio source) should be identified as the primary reason for depolarization. Also, it appeared that the masses of ionized gas would increase with an increase in the linear sizes of the components of the radio sources as they expand. (Diss. Abstr. Int., B)

18210 EQUILIBRIUM DISTRIBUTION OF GAS IN CLUSTERS OF GALAXIES. Lea, S. M. (Ames Research Center, Moffett Field, CA). Astrophys. Lett.; 16: No. 4, 141-144(1975).

The hydrostatic equilibrium solution for a polytropic gas in a cluster of galaxies has been calculated. The gas has a wider distribution than the galaxies. If the central gas density is 8×10^{-4} particles cm^{-3} for $\gamma = 5/3$ or 2×10^{-3} cm^{-3} for $\gamma = 1.35$ the total x-ray emission from a model Coma cluster is equal to the observed emission. The spatial extent and spectrum for the source are also well-represented by the model, if $\gamma = 1.35$. (auth)

18211 OBSERVATIONS OF WATER LINE EMISSION NEAR THREE COMPACT INFRARED SOURCES. White, G. J.; Little, L. T. (Univ. of Kent, Canterbury, Eng.). Astrophys. Lett.; 16: No. 4, 151-154(1975).

Observations of water line emission from regions near three compact infrared sources are reported. A new water source has been discovered in S140. New components have been observed in NGC 1333, one of which decreased in intensity by a factor of 2.5 over three days. The position of the W51(N) water source differs by 9″ ± 10″ from that of the compact H II/infrared source IRS-2 in W51. (auth)

18212 LABORATORY MEASUREMENTS OF SOME ION-MOLECULE REACTIONS RELATED TO SULPHUR CHEMISTRY IN INTERSTELLAR CLOUDS. Liddy, J. P.; Freeman, C. G.; McEwan, M. J. (Univ. of Canterbury, Christchurch, N. Z.). Astrophys. Lett.; 16: No. 4, 155-157(1975).

H_2S and a number of other molecules containing sulphur have been observed in dense interstellar clouds. A scheme for the chemistry of these sulphur-containing species was recently discussed by Oppenheimer and Dalgarno. They included in their scheme a number of ion-molecule reactions of sulphur compounds. In the laboratory rate coefficients of several ion-molecule reactions in the Oppenheimer–Dalgarno scheme (involving H_2S^+, H_2S, SO^+, SO_2 and S^+) have been measured as well as several related reactions. (auth)

18213 INFRARED OBSERVATIONS OF THREE UNUSUAL NEBULAE. Cohen, M. (Univ. of California, Berkeley, CA); Barlow, M. J. Astrophys. Lett.; 16: No. 4, 165-171(1975).

Optical, infrared and radio data are assembled on the three objects M1−67, Sh2-266 and NGC 2346 which previously have been classified as planetary nebulae. It is argued that none of these nebulae is in fact a planetary. M1−67 is almost certainly a ring nebula containing a Population I WN star; Sh2-266 is probably a nebulosity containing an emission-line B star; while the nature of NGC 2346 is presently indeterminate. (auth)

18214 COMPARISON OF THE RADIO AND OPTICAL ORIENTATIONS OF ELLIPTICAL GALAXIES IDENTIFIED WITH DOUBLE RADIO SOURCES. Sullivan, W. T. III.; Sinn, L. A. (Univ. of Washington, Seattle). Astrophys. Lett.; 16: No. 4, 173-177(1975).

The position angles of the major axes of elliptical galaxies (θ_g) are compared with the position angles of the associated double radio sources (θ_r) for a sample of 15 galaxies; in each case the galaxy is centrally located with respect to the radio components. The distribution of $|\theta_g - \theta_r|$ is most simply interpreted as arising from ejection of the radio components in random directions with respect to the distribution of light. Besides the random-ejection hypothesis, the distribution is statistically consistent, if galaxies are oblate rotators, with only the gravitational slingshot model. If galaxies are prolate rotators, the distribution is inconsistent with magnetohydrodynamic models which predict ejection along the axis of rotation. Data support the measurements of Gibson (1975) and differ from those of Mackay (1971) and Bridle and Brandie (1973). (auth)

18215 SPECTROSCOPY OF SELECTED COMA CLUSTER GALAXIES. Gregory, S. A. (State Univ. of New York, Oswego). Publ. Astron. Soc. Pac.; 87: No. 519, 833-834(Oct 1975).

New determinations of redshift are given for 14 galaxies in the direction of the Coma cluster. Nine of these galaxies have not been studied spectroscopically before. The comparison of the new redshifts of the remaining five galaxies with those published previously is good with (V/sub new/ - V/sub old/) equals -29 km sec^{-1}. (auth)

18216 SURFACE BRIGHTNESSES OF FIRST-RANKED CLUSTER GALAXIES. Gudehus, D. H. (Univ. of California, Los Angeles). Publ. Astron. Soc. Pac.; 87: No. 519, 763-768(Oct 1975).

It is shown that Sandage's arguments for a constant mean surface brightness of first-ranked cluster ellipticals are incorrect. In addition, a cosmic dispersion of 0.29 mag is found and first-ranked galaxies in irregular clusters appear to have brighter than average surface brightness. The potential usefulness of a surface brightness-redshift plot as an important cosmological test is discussed.

18217 INFRARED AND MILLIMETER OBSERVATIONS OF MARKARIAN 231. Joyce, R. R. (Kitt Peak National Observatory, Tucson, AZ); Knacke, R. F. Publ. Astron. Soc. Pac.; 87: No. 519, 683-693(Oct 1975).

New infrared and 3.3 millimeter observations of the Seyfert galaxy, Markarian 231, are reported. Thermal and nonthermal models of the radiation source are discussed although it is not possible to specify a unique model based on these data. (auth)

18218 SMALL DIFFUSE NEBULAE. Matthews, C. J. L. Urbana, IL; Univ. of Illinois (1975). 82p. University Microfilms Order No. 75-24,364.

Thesis (Ph. D.).

Ten small HII regions have been studied by filter photometry at the Prairie Observatory of the University of Illinois and with the Harvard scanner and the No. 1 36-inch telescope at Kitt Peak. Absolute H alpha and H beta fluxes were measured for all ten, and fluxes in the lambda 3727, lambda 7324 [OII], lambda 6548, lambda 6584 [NII], and lambda 4959, lambda 5007 [OIII] lines were obtained for most of them. Extinction constants have been determined from H alpha/H beta ratios and also from radio/H beta ratios when possible. Values of electron temperature are found to lie within the range 5500°K to 7500°K. Values of electron density, calculated from the [OII] lambda 7324/lambda 3727 line ratio, are of the order of magnitude 100 or lower. Nitrogen to oxygen ratios were calculated for each of the regions. The average value of the nitrogen to oxygen ratio for the six best observed regions is 0.134, very close to the solar value. (Diss. Abstr. Int., B)

18219 MASS OF THE LOCAL GROUP. Herbst, W. (York Univ., Downsview, Ont.). Publ. Astron. Soc. Pac.; 87: No. 519, 827-829(Oct 1975).

The effect of varying the rotation velocity of the local standard of rest on the stability of the Local Group is investigated. It is concluded that, unless theta_0 greater than approximately 290 km sec^{-1}, unseen mass is probably required for stability. (auth)

Cosmology

Refer also to abstracts 17977, 18083, 18084, 18096, 18112, 18187, 18308, 19360, 19361, and 19369.

18220 GRAVITATIONAL RADIATION RECOIL ON AN N-BODY SYSTEM. Dionysiou, D. C. (Univ., Athens). Gen. Relativ. Gravitation; 6: No. 3, 319-324(Jun 1975).

A formula of gravitational radiation recoil of an N-body material system is presented. (auth)

18221 CHARGE CONJUGATION AND SEGAL'S COSMOLOGY. Sternberg, S. (Tel-Aviv Univ., Israel); Wolf, J. A. Nuovo Cim., A; 28A: No. 2, 253-271(21 Jul 1975).

It is shown that the operation of charge conjugation (and hence also CPT) can be realized as an actual geometric transformation within the framework of Segal's chronogeometric theory. Some geometric questions connected to the foundations of the chronogeometric theory are also discussed. (auth)

18222 PARTICLE CREATION IN THE VORTEX COSMOLOGICAL MODEL. Lukash, V. N.; Novikov, I. D.; Starobinskii, A.A. (Inst. of Cosmic Research, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1484-1500(Nov 1975). (In Russian).

The problem of particle creation near a singularity and the inverse effect of the particles on the metric in the homogeneous vortex model considered previously is solved. A complete picture of evolution of the vortex model is developed by taking into account matter production. It is shown that particle production near a singularity at $t \gtrsim t_{pt}$ results in a strong decrease of the primeval vortex velocity of matter which is found to be insufficient for the vortex theory of origin of galaxy rotation and does not result in a decrease (compensation) of the total angular momentum of matter by the angular momentum of the created free particles (gravitons), the graviton momentum oscillating with an increasing amplitude. Restrictions on the parameters of the vortex model are presented which follow from observations of the chemical composition of prestellar matter and the isotropic relic background. (auth)

18223 EFFECT OF VISCOSITY ON THE NATURE OF COSMOLOGICAL EVOLUTION. Belinskii, V. A.; Khalatnikov, I. M. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 2, 401-413(Aug 1975). (In Russian).

The nature of cosmological solutions for the homogeneous type I Bianchi model is investigated by taking into account dissipative processes due to viscosity. It is demonstrated that viscosity cannot remove the cosmological singularity but results in a qualitatively new behavior of the solutions near the singularity. The energy density of matter near the initial cosmological singularity vanishes and then begins to increase during subsequent expansion. Thus the model under consideration possesses an interesting property: matter is created by the gravitational field during the time of the "big bang". It is also shown that an effect of viscosity may be a sufficient accumulation of entropy which may be related to the anomalously high amount of entropy per particle encountered in the current universe. (auth)

18224 GLOBAL TIME PROBLEM IN RELATIVISTIC COSMOLOGY. Heller, M. (Univ., Louvain, Belgium). Ann. Soc. Sci. Brux. Ser. I; 89: No. 4, 522-532(20 Nov 1975).

By imposing certain causality conditions upon space-time manifold M it is possible to define, in a natural way, such strong structures as full topology, certain ordering of events which are called "topological time", and global metric time on M. (auth)

18225 PROPAGATION OF GRAVITATIONAL RADIATION IN DENSE MEDIA. Ross, D. K. (Iowa State Univ., Ames). J. Phys., A (London); 8: No. 9, 1398-1408(Sep 1975).

Einstein's field equations are solved for gravitational radiation propagating in a background metric given by the interior Schwarzschild solution. Expressions for the transmitted fraction as a function of frequency and propagation distance are found. Absorption is found to be present only for frequencies less than a critical frequency, the "gravitational plasma frequency," which is roughly proportional to the square root of the mean density of the medium. The plasma frequency ν_{crit} is found to be a useful concept for gravitational radiation, though the fraction transmitted does not fall as rapidly with distance of propagation below ν_{crit} as it does in the analogous electromagnetic case and the transition to total transmission is not as abrupt as a function of frequency. For a neutron star ν_{crit} = 6700 Hz, well above the low frequencies of most current gravitational radiation detectors. (auth)

18226 COSMOLOGICAL MODELS IN ROSEN'S THEORY OF GRAVITATION. Babala, D. (ASEA-ATOM AB, Vaesteraas, Sweden). J. Phys., A (London); 8: No. 9, 1409-1412(Sep 1975).

Solutions of Rosen's equations of gravitation for a homogeneous isotropic universe are obtained. The solutions resemble the Lemaitre universe. A universal repulsive force, introduced in general relativity by a positive cosmological constant, appears here directly as a consequence of the (unmodified) field equations. (auth)

18227 LIGHT SCATTERING PROPERTIES OF NAKED SINGULARITIES. Sandberg, V.D. (Department of Physics, University of

Utah, Salt Lake City, Utah 84112). Phys. Rev. D 12: No. 8, 2226-2229 (15 Oct 1975).

The astrophysical implications of the light scattering and capture cross sections of a Curzon naked singularity are discussed. It is found that a Curzon naked singularity possesses a neatly circular capture cross section for photons of approximately the same size as that of a Schwarzschild black hole of equal mass. This suggests that a black hole and a naked singularity can produce similar astrophysical effects. (auth)

18228 EXPLOSIVE EVENTS IN THE EARLY UNIVERSE. Schwarz, J.; Ostriker, J.P.; Yahil, A. (Princeton University Observatory). Astrophys. J. 202: No. 1, 1-6 (15 Nov 1975).

Large-scale explosions, possibly the cumulative effects of supernovae, may have occurred in the early history of the Universe ($10 \geq z \geq 2$). The observed metal abundances in evolved stars in giant ellipticals suggest that as much as 10^{61} ergs per solar mass of metal-rich material might have been released. Alternatively, the energy output of any galaxy can be estimated at 5×10^{61} ergs per present visual solar luminosity. Blast waves from such a large input of energy could heat and ionize an intergalactic medium (IGM) of closure density to a degree that would be consistent with the limits on both the 21-cm absorption in nearby radio sources and the Lα absorption in quasars. The bremsstrahlung radiation emitted by the ionized gas might explain the possible excess observed in the diffuse X-ray background below 1 keV. (auth)

18229 ON DEFINING "REST" IN ROBERTSON-WALKER COSMOLOGIES. Fox, J.G.; Jacobs, K.C. (Leander McCormick Observatory, University of Virginia); Thomsen, B.; von Hoerner, S. Astrophys. J. 201: No. 3, 545-546 (1 Nov 1975).

An earlier conclusion, that peculiar motions of test particles in empty Robertson-Walker cosmologies are potentially observable, is here shown to be incorrect. (auth)

18230 CYLINDRICALLY SYMMETRIC COSMOLOGICAL SOLUTIONS OF THE LYTTLETON–BONDI UNIVERSE. Rao, J. R.; Panda, H. S. (Indian Inst. of Tech., Kharagpur). J. Phys., A (London); 8: No. 9, 1413-1422(Sep 1975).

The exterior field of the Einstein–Rosen cylindrically symmetric metric in the Lyttleton–Bondi universe is considered and exact solutions are obtained in some specific situations. The solutions exhibit singularities on the z axis as well as at spatial infinity. The geodesic path of a test particle exhibits a spiral structure around the axis of symmetry. (auth)

18231 SINGULARITIES IN GENERAL RELATIVITY AND AN INTRODUCTION OF NEW RELATIVISTIC THEORIES OF GRAVITATION. Junevicus, G. J. G. Victoria, British Columbia; Univ. of Victoria (1975). vp. National Library of Canada, Ottawa.

Thesis (Ph. D.).

Certain aspects of general relativity and the formulation of new relativistic theories of gravitation are discussed. The connection between the finiteness or nonfiniteness of scalars formed from the Riemann tensor and intrinsic singularities is examined. The use of indeterminacies in these scalars as indicators of intrinsic singularity and the possible significance of such use to the Schwarzschild horizon and the concept of black holes is considered. Aspects of particular Weyl class solutions are explored. The classical tests of the general theory of relativity are examined with emphasis on the extent to which they actually invoke the full structure of the theory. Three phenomenological models are developed, each having the Schwarzschild solution of Einstein's general relativity theory as its static spherically symmetric vacuum solution. The significance of the phenomenological models with regard to the tests of general relativity is discussed. Four formal theories, variations on the basic theme of using the calibration extensions in conjunction with the action principle, are developed and various aspects discussed. All are shown to satisfy the Newtonian and special relativistic limits. In addition, two of the variations lead to field equations which are shown to reduce to the wave equation in the limit of weak fields and high velocities. The static spherically symmetric vacuum solution for all four theories is obtained and shown to be identical to that of Einstein theory. The significance of the latter result with regard to the viability of the theories in the context of the classical tests of relativity is discussed. (Diss. Abstr. Int., B)

Planetary Phenomena

Refer also to abstracts 17219, 17279, 18075, 18117, and 19358.

18232 EXPERIMENTS WITH PLASMA WAVES. Thomas, J. O. (Imperial Coll. of Science and Tech., London). Philos. Trans. R. Soc. London, Ser. A; 280: No. 1293, 193-224(23 Oct 1975).

Plasma waves play an important role in planetary plasma envelopes and in astrophysical plasmas. Attention is mainly concentrated on waves propagating in a narrow band of frequencies near the plasma frequency and on those often referred to as the electron Bernstein modes. The latter propagate with wavevectors in a direction closely perpendicular to an applied magnetic field. Their existence is not predicted by cold plasma theory. They are, however, easy to excite in relatively simple laboratory experiments and provide an instructive laboratory demonstration of effects depending on thermal motions in a plasma. An interference experiment designed to detect and to make measurements on such waves is described. Dispersion properties are in good agreement with the predictions of the kinetic theory of hot magnetoplasmas. Three dimensional ray tracing in hot magnetoplasmas in a narrow band of frequencies near the plasma frequency, including Doppler shifts, has confirmed the feasibility of a plasma wave radar which can provide a good technique for determining electron temperatures and densities and their gradients. Computational and analytical techniques have been proposed to determine these quantities. A brief assessment is given of the use of plasma waves in space and laboratory plasma diagnostics. (auth)

18233 ROLE OF NUCLEAR REACTIONS IN THE EVOLUTION OF MATTER IN THE SOLAR SYSTEM. Lavrukhina, A. K. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 126-133(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 395-402(1975).

Experimental data on isotopic abundances and the cross sections for nuclear reactions are used in a discussion of the nucleosynthesis of various isotopes during the formation and evolution of the solar system. (auth)

18234 DIAGNOSTICS OF THE AZIMUTHAL COMPONENT OF THE INTERPLANETARY MAGNETIC FIELD FROM TERRESTRIAL OBSERVATIONS. Fel'dshtein, Ya. I.; Sumaruk, P. V.; Shevnina, N. F. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Dokl. Akad. Nauk SSSR; 222: No. 4, 833-836(1 Jun 1975). (In Russian).

A close linear connection is found for the hourly values of the vertical component Z at the Tule observatory ($\phi' \sim 86°$) and the azimuthal component of the interplanetary magnetic field at midday hours of the summer season. This relation at Tule exists all hours of the day in the summer season with the susceptibility to the change in azimuthal component Y_{SE} in the solar-ecliptic system of coordinates depending substantially on the time of day. An analysis was made of the mutual relation of the magnitude and direction of Y_{SE} with variations in the horizontal component (X or H) at observatories of the northern hemisphere at magnetically quiet periods. The amplitude in the change of magnetic susceptibility ΔZ over a period of days increases from the observatory Alert to the observatory Resolute Bag. The greatest variations in ΔZ are attained at the pre-midday hours at $\phi' \sim 84$ to 85°. An increase in ΔZ in 1966 is related to an increase in ionospheric conductivity as a result of an increase in solar activity. From a knowledge of ΔZ from data of terrestial observations it is possible to calculate the magnitude and direction of the azimuthal component Y_{SE} in the summer season of 1965 and 1966. (SJR)

18235 DETECTION OF SIMPLE WAVES IN THE INTERPLANETARY PLASMA. Stakhanov, I. P. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Dokl. Akad. Nauk SSSR; 223: No. 3, 593-595(21 Jul 1975). (In Russian).

It is assumed that a satellite exchanges radiosignals with a radio station on earth. A formula is given for the phase difference $\Delta\phi$ of signals from an inquiring station and a responding station having a generator frequency signal 2ω twice the generator frequency of the inquiring station. It is shown that the region near the responding station ($r \sim R$), where R is the distance between the stations, does not contribute to the phase difference $\Delta\phi$. Hence if an inquiring signal is sent from a sufficiently distant satellite and the responding signal from the earth, the phase difference is determined mainly by plasma displacements in interplanetary space with the effect of the earth's ionosphere being almost completely excluded. Estimates show that with a change in plasma density of 1 to 10 particles per 1 cm^3, a velocity μ of 500 km/sec, a signal frequency of 40 megahertz, and a relative stability $s = \delta\omega/\omega \sim 10^{-11}$, the resulting beat (or phase difference) can be detected, since the relative beat frequency is much larger than the relative stability. Ionospheric disturbances are almost completely excluded, and have no effect on the result. (SJR)

18236 RADIOGENIC ATMOSPHERE OF THE MOON. Bulashevich, Yu. P.; Khachai, Yu. V. (Inst. of Geophysics, Sverdlovsk, USSR). Geokhimiya; No. 4, 624-627(Apr 1975). (In Russian).

The radiogenic components of the lunar atmosphere caused by the release of ^{40}Ar and ^{4}He from the interior of the moon are

evaluated theoretically and the results are compared with experimental results. (JSR)

18237 EXCITATION OF GEOMAGNETIC PULSATIONS OF THE SERPENTINE-EMISSION TYPE IN THE INTERPLANETARY PLASMA. Gul'el'mi, A. V.; Dovbnya, B. V.; Klain, B. I. (Inst. of the Physics of the Earth, Yaroslav, USSR). Dokl. Akad. Nauk SSSR; 221: No. 6, 1314-1317(21 Apr 1975). (In Russian).

Circumstantial proof is given that the serpentine-like emissions previously observed at the polar caps have an extra-magnetospheric origin. (JSR)

18238 HYPERBOLIC COSMIC DUST: ITS ORIGIN AND ITS ASTROPHYSCIAL SIGNIFICANCE. Zook, H. A. (National Astronautics and Space Administration, Houston, TX). Planet. Space Sci.; 23: No. 10, 1391-1397(Oct 1975).

The heliocentric radial distribution of the flux of hyperbolic cosmic dust particles, as measured by the Pioneer 8 and 9 spacecrafts, is closely related to the radial variation of the spatial density of source or "parent" meteoroids. Within the limits of the experimental and theoretical uncertainties the spatial density of parent meteoroids, as deduced from the hyperbolic cosmic dust data, is found to be increasing with increasing heliocentric distance in the neighborhood of one a.u. Other recent experimental evidence confirms this result. The new results also suggest that the ratio of the areal density of submicron sized craters to the areal density of millimeter sized craters will be less on the north-south faces of lunar rocks than on the east-west faces of the same rocks. The change in ratio is not as large as previously thought, however. Finally it is noted that the solar system is not presently contributing significant amounts of dust to the interstellar medium though it may once have done so. (auth)

18239 FURTHER OBSERVATIONS OF THE 8–13 MICRON SPECTRUM OF TITAN. Gillett, F.C. (Kitt Peak National Observatory). Astrophys. J. Lett. 201: No. 1, L41-L43 (1 Oct 1975).

Spectrophotometric observations of Titan, covering the range 7.8–13.3 μ with $\Delta\lambda/\lambda \simeq 0.02$, are presented. The resulting spectrum is in excellent agreement with the predicted spectrum based on an inversion model for Titan's atmosphere. In addition to emission bands of methane (CH_4) and ethane (C_2H_6), evidence is found for emission by acetylene (CH_2H_2), ethylene (C_2H_4), and monodeuterated methane (CH_3D). (auth)

18240 MICROWAVE CONTINUUM RADIATION FROM COMET KOHOUTEK 1973f: EMISSION FROM THE ICY-GRAIN HALO? Hobbs, R.W.; Maran, S.P.; Brandt, J.C. (Laboratory for Solar Physics and Astrophysics, NASA-Goddard Space Flight Center, Greenbelt, Maryland); Webster, W.J. Jr.; Krishna, K.S. Swamy. Astrophys. J. 201: No. 3, 749-755 (1 Nov 1975).

Cometary emission was measured at 3.71 cm on 1974 January 10–11. A possible detection at 2.8 cm and an upper limit at 11.1 cm are also reported. Interferometer measurements at 3.71 cm show that the angular diameter is $< 1''.4$ or < 850 km at the comet. The corresponding disk brightness temperature is $> 313 \pm 80$ K. The radiation presumably originates in the icy-grain halo postulated by Delsemme. (auth)

18241 SUBSTORMS ON MERCURY? Siscoe, G.L.; Ness, N.F.; Yeates, C.M. (Department of Physics and Center for Space Research, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). J. Geophys. Res. 80: No. 31, 4359-4363 (1 Nov 1975).

The Mariner 10 encounter of Mercury provided data showing a strong interaction between the solar wind and the planet similar to a scaled down version of that producing the earth's magnetosphere. Some of the features observed in Mercury's night side magnetosphere suggest time-dependent processes occurring there. Interpreted as temporal events, these features bear striking resemblances to substorm phenomena in the earth's magnetosphere. (auth)

18242 DISCUSSION OF PAPER BY S. S. PRASAD AND A. TAN "THE JOVIAN IONOSPHERE". Strobel, D.F. (Naval Research Laboratory, Washington, D. C. 20375). Geophys. Res. Lett. 2: No. 11, 521-522 (Nov 1975).

The electron density of the Jovian hydrocarbon ion layer due to CH_3 photoionization has been overestimated by approximately a factor of 7 and is insignificant when compared with the Pioneer 10 results. (auth)

18243 COMMENTS ON DARRELL F. STROBEL'S DISCUSSION OF PAPER BY S. S. PRASAD AND A. TAN "The JOVIAN IONOSPHERE". Prasad, S.S. (Jet Propulsion Laboratory, 4800 Oak Grove Drive, Pasadena, CA 91103). Geophys. Res. Lett. 2: No. 11, 523-524 (Nov 1975).

Examination of the viewpoints expressed by Strobel reveal several inconsistencies which show that his conclusions are not well founded, and certainly do not provide any substantial justification for ignoring the possible role of CH_3 photoionization in the Jovian ionosphere, at least at this time. (auth)

18244 OBSERVATIONS OF COMET KOHOUTEK (1973f) WITH A GROUND-BASED FABRY-PEROT SPECTROMETER. Huppler, D.; Reynolds, R.J.; Roesler, F.L.; Scherb, F.; Trauger, J. (Physics Department, University of Wisconsin, Madison). Astrophys. J. 202: No. 1, 276-282 (15 Nov 1975).

Observations of Hα, H_2O^+, and [O I] emission lines from comet Kohoutek were made during a 2-month period around perihelion. Analyses of Hα line profiles and line intensities indicate that the mean outflow velocity of the hydrogen atoms was 7.8 ± 0.2 km s^{-1} and that the hydrogen atom production rate typically varied from about 0.4×10^{29} s^{-1} to about 1.4×10^{29} s^{-1} for comet-Sun distances between 1 AU and 0.4 AU, respectively. The identification of an H_2O^+ emission feature in certain Hα scans indicates that the H_2O^+ ions were moving in a tailward direction with a velocity of 20 to 40 km s^{-1} with respect to the comet nucleus. An upper limit of 1 part in 100 was found for the D/H ratio in the cometary atomic hydrogen cloud. (auth)

18245 OBSERVATION OF THE ν_2 BAND OF PH_3 IN THE ATMOSPHERE OF SATURN. Bregman, J.D.; Lester, D.F.; Rank, D.M. (Lick Observatory, Board of Studies in Astronomy and Astrophysics, University of California, Santa Cruz). Astrophys. J. Lett. 202: No. 1, L55-L56 (15 Nov 1975).

Observation of the ν_2 band of PH_3 in the Saturnian atmosphere represents the first positive identification of this compound in the planet. The observed spectrum is consistent with line formation in the planet's troposphere where the dominant sources of opacity are molecular hydrogen and unsaturated phosphine vapor. (auth)

18246 Z VARIATIONS IN THE POLAR REGION AS A FUNCTION OF THE INTENSITY OF AND SIGN OF THE AZIMUTHAL COMPONENT OF THE INTERPLANETARY MAGNETIC FIELD. Sumaruk, P. V.; Fel'dshteyn, Ya. I.; Shevnina, N. F. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 899-904(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1069-1075(1974).

Relations associating the values of the vertical component in Thule (Z_T) with the intensity of the azimuthal component of the interplanetary magnetic field (Y_{SE}) at various times of the day in summer and during the equinox are obtained for the solar activity minimum (1965 and 1966). (auth)

18247 CHARACTERISTICS OF THE ANNUAL VARIATIONS OF THE IONOSPHERIC EFFECT OF THE SECTOR STRUCTURE OF THE INTERPLANETARY MAGNETIC FIELD. Shapiro, B. S.; Potapova, N. I. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 925-926(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1099-1100(1974).

The difference in the critical frequencies and heights of the maximum of the F_2 layer, averaged separately for days with the interplanetary magnetic field directed away from and toward the sun is investigated. (auth)

18248 EFFECT OF THE SECTOR STRUCTURE OF THE INTERPLANETARY MAGNETIC FIELD ON THE IONOSPHERIC F_2 LAYER AT MIDDLE LATITUDES. Potapova, N. I.; Shapiro, B. S. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 927-928(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1101-1102(1974).

An investigation is made of the variations of the critical frequencies f_0 and heights of the maximum h_{max} of the F_2 layer, which were averaged separately for days with the interplanetary field directed away and toward the sun. Furthermore, the value $\delta^* f_0 = \overline{\Delta f_{0+}} - \overline{\Delta f_{0-}}$ is computed, where $\overline{\Delta f_{0+}}$ and $\overline{\Delta f_{0-}}$ are the deviations of f_0F_2 from the moving median, averaged for the days of each month separately for a positively and negatively directed interplanetary field. (auth)

18249 COSMIC FORCE-FREE MAGNETIC FIELDS. Korchak, A. A.; Molodensky, M. M. Comments Astrophys. Space Phys.; 6: No. 3, 81-85(1975).

The geometrical properties of force-free magnetic fields are discussed as well as the analogy between force-free fields and harmonical fields. The stability of force-free configurations is considered. (BJG)

PHYSICS (ATMOSPHERIC)

Auroral and Ionospheric Phenomena

Refer also to abstracts 16779, 17939, 18246–18248, 18328, and 18343.

18250 (AD/A-008210) EXCITATION OF INFRARED ACTIVE ATMOSPHERIC SPECIES BY GROUND BASED rf TRANSMITTERS. Final Report, 1 June 1973–31 July 1974. Manley, O. P. (Visidyne, Inc., Burlington, Mass. (USA)). 20 Jan 1975. Contract DNA 001-73-C-0263. 48p. (VI–252). NTIS $3.75.

The use of existing experimental facilities for E-region modification has been assessed in the context of exciting IR active atmospheric species (e.g. NO) in the ionosphere. A brief review of pertinent airglow measured from the modified F-region is given, and the elements of the theory necessary to explain the observations are outlined. It is shown that, even if the nonlinear aspects of the theory of ionospheric modifications are ignored, the existing facilities at Platteville, Colorado, should be capable of generating enhanced NO emissions in the E region which should be observable from aircraft altitudes. Existing sparse data from E-region modification experiments suggest that the effects of nonlinearities cannot be ignored. Hence, the estimates presented here should be viewed as a lower bound on emission levels. (GRA)

18251 (COM-75-50250-39/SL) AURORAL ELECTROJET MAGNETIC ACTIVITY INDICES AE (11) FOR 1971. Allen, J. H.; Abston, C. C.; Morris, L. D. (World Data Center A for Solar-Terrestrial Physics, Boulder, Colo. (USA)). Feb 1975. 152p. (UAG-39). National Climatic Center, Asheville, NC.

See also COM-74-50276-33.

The Auroral Electrojet index (AE) is discussed and a brief description is given of the derivation of 11-station, 2.5-min AE indices for 1971. Tables are given of hourly average indices for each day of the year, the stations making the main contribution to the hourly indices, and of the average monthly quiet-time level of horizontal fields (H) at each magnetic observatory. Graphs of the index variations are included for each day of 1971. (GRA)

18252 IONOSPHERIC IRREGULARITIES AND RADIO SCINTILLATIONS. Briggs, B. H. (Adelaide Univ.). Contemp. Phys.; 16: No. 5, 469-488(Sep 1975).

The study of ionospheric scintillations and of irregularities of electron density in the ionosphere are reviewed. Radio star scintillations take the form of fluctuations of both amplitude and phase. In practice the intensity fluctuations are easier to observe, and have therefore received the most study. The ionosphere can only impress phase fluctuations across the wavefront and thus the fact that intensity fluctuations are observed is surprising. Using some aspects of diffraction theory this problem is considered. Observations of ionospheric scintillations to ascertain statistics of occurrence and information about the shapes and sizes of the ionospheric irregularities, and the heights at which they occur are described. Finally theories of the origin of the ionospheric irregularities are discussed. (UK)

18253 SIMULTANEOUS OBSERVATIONS OF EVENING MAGNETIC PULSATIONS AND MORNING ELECTRON PRECIPITATION EVENTS IN THE AURORAL ZONE DURING THE SUBSTORM. Lukkari, L. (Oulu Univ., Finland); Kangas, J.; Heacock, R. R. J. Atmos. Terr. Phys.; 37: No. 10, 1305-1311(Oct 1975).

Simultaneous observations of magnetic pulsations and electron precipitation events on the evening and morning side of the auroral zone have been analyzed. The development of these events is closely related with the source processes characterized by the electron precipitation events in the midnight sector during the substorm. When an SVA event is observed on the morning side a typical sequence of evening side magnetic pulsations consists of unstructured Pc 1-2 waves appearing before the onset of the substorm and a subsequent IPDP event appearing after the onset of the substorm. The preceding activity does not always merge into the IPDP in a continuous way. The observations are discussed in the frame of the varying amplification of waves via ion cyclotron resonance around the plasmapause region. (auth)

18254 SIMPLIFIED D-REGION MODEL AND ITS APPLICATION TO MAGNETIC STORM AFTER-EFFECTS. Spjeldvik, W. N.; Thorne, R. M. (Univ. of California, Los Angeles). J. Atmos. Terr. Phys.; 37: No. 10, 1313-1325(Oct 1975).

'Energetic electron precipitation from the Earth's radiation belts can provide the dominant D-region ionization source at middle latitudes during the recovery phase of geomagnetic storms. To study the ionospheric response, a simplified D-region ionic model is developed with emphasis placed on obtaining a reasonably accurate evaluation of the free electron concentration. The precise distribution amongst the multiply hydrated water cluster ions and high affinity negative ions is not considered. Instead, the complicated heavy ion chemistry is replaced by a scheme which simply applies an average rate of clustering and subsequent recombination. The model provides an adequate fit with observed quiet-time electron concentration in the D-region. It is shown that typical electron precipitation can increase mesospheric electron densities by a factor of three during the day and by more than an order of magnitude at night. Such enhancements are consistent with VLF and LF radio wave disturbances observed during the recovery phase of major geomagnetic storm. The disturbances are expected to exhibit considerable short term variability and should persist for over a week consistent with the observed decay rate for the enhanced geomagnetically trapped electron flux. (auth)

18255 ANALYSIS OF PROCESSES LEADING TO LOCALIZED ELECTRON ENHANCEMENTS IN THE OUTER RADIATION BELT. Morfill, G.; Scholer, M.; Hovestadt, D. (Max-Planck-Institut fuer Physik und Astrophysik, Garching, Ger.). Planet. Space Sci.; 23: No. 11, 1495-1506(Nov 1975).

New information obtained about > 500 keV electron intensity enhancements, which have been observed intermittently close to the outer edge of the electron radiation belt, is used in conjunction with an earlier statistical study to investigate processes which could lead to such structures. The enhancements are typically of ~20 sec duration and occur in a very narrow invariant latitude band, maximally 2° wide. The intensity increase relative to the "normal" background level is up to a factor 10, and the "spike" frequency of occurrence is strongly local time dependent, with more spikes observed in the night and dusk-noon sectors than in the noon-dawn sector. The processes investigated quantitatively are distortions of the magnetospheric topology in the equatorial region, wave-particle interactions and the effects of ionospheric currents. It is shown that the various processes which contribute to equatorial field disturbances can explain the observations. (auth)

18256 ALTERATION OF THE IONOSPHERE BY MAN-MADE WAVES. Fejer, J. A. (Univ. of California, San Diego, La Jolla). Philos. Trans. R. Soc. London, Ser. A; 280: No. 1293, 151-165 (23 Oct 1975).

In recent years powerful radio wave transmissions beamed at the ionosphere at frequencies somewhat below the penetration frequency of the F2 layer produced the following, mostly unexpected, spectacular effects. Artificial spread F seen on ionograms and implying the presence of large scale field-alined irregularities in the ionospheric plasma density. Very strong additional absorption of probing waves reflected by the F2 layer. Field-alined "on frequency" scattering of uhf waves. Scattering of uhf waves by Langmuir waves which are believed to be parametrically excited. The 630 nm airglow is artificially enhanced by a modifying wave of ordinary polarization but it is reduced in intensity by a modifying wave of extraordinary polarization. The shape of the F2 layer is modified. The results of the observations are described and their tentative interpretation in terms of different parametric instabilities is outlined. (auth)

18257 SATELLITE OBSERVATIONS OF THE NITRIC OXIDE NIGHTGLOW. Gerard, J. C. Geophys. Res. Lett.; 2: 179-182 (May 1975).

18258 DELAYED STORM-TIME INCREASES IN THE WHISTLER RATE AT MID-LATITUDES. Andrews, M. K. (Dept. of Scientific and Industrial Research, Lower Hutt, N.Z.). J. Atmos. Terr. Phys.; 37: No. 11, 1423-1426(Nov 1975).

The occurrence of whistlers during 105 magnetic storms in the period 1963 to 1968 is studied. Evidence that more whistlers occur during the storm recovery period is presented. Assuming that the increased whistler rate implies the presence of more ducts, similarities are noted between the storm-time duct population and the incidence of mid-latitude spread-F in both time and space. It is suggested that a fresh examination of the physical processes involved in spread-F may aid understanding of the formation of whistler ducts. (auth)

18259 PHASE AND AMPLITUDE ANALYSIS OF RADIO ECHOES FROM THE IONOSPHERE. Whitehead, J. D.; Monro, P. E. (Queensland Univ., St. Lucia, Australia). J. Atmos. Terr. Phys.; 37: No. 11, 1427-1430(Nov 1975).

Radio echoes from the ionosphere are Doppler shifted in frequency due to horizontal and vertical motions. Fourier analysis

of the phase and amplitude of the received signal may be used to give angular and height resolution. It is shown that the angular resolution is the angular size of the first Fresnel zone and that for D-region echoes, taken as an example, the height resolution is significantly better than the usual method of pulse separation. (auth)

18260 ROUTINE WHISTLER ANALYSIS BY MEANS OF ACCURATE CURVE FITTING. Tarcsai, G. (Eotvos Lorand Tudomanyegyetem, Budapest). J. Atmos. Terr. Phys.; 37: No. 11, 1447-1457(Nov 1975).

A new method has been developed for the reliable, routine analysis of whistlers with unknown nose frequency and causative sferic. The method is based on the least squares estimation of two parameters (D_0 and f_{HE}) in Bernard's (J. Atmos. Terr. Phys.; 35:871(1973)) approximation for the dispersion, and of a third parameter locating the causative sferic. A comparison on measured whistlers showed that the new method has certain advantages over the method described by Rycroft and Mathur (J. Atmos. Terr. Phys.; 35: 2177(1973)) and is more reliable than the procedure developed by Ho and Bernard (J. Atmos. Terr. Phys.; 35:881(1973)). The equatorial electron density n_e and electron tube content N_T values were computed using Park's (J. Geophys. Res.; 75: 4249(1970)) expressions. A careful error analysis performed on about one hundred whistlers ($1.4 \leq L \leq 3.3$), analyzed by the new method, indicated that errors in n_e and N_T are less at about $L = 3.1$ to 3.3 and $L = 2.3$ to 2.5, respectively. The analysis of travel time residuals proved to be useful in studying the measurement errors and the approximations that have been made. (auth)

18261 SIMPLE ION SOURCE FOR IONOSPHERIC EXPERIMENTS. Giles, M.; Martelli, G. (Univ., Sussex, Brighton, Eng.). J. Atmos. Terr. Phys.; 37: No. 11, 1485-1489(Nov 1975).

It is suggested that the presence of "parallel" electric fields in the auroral ionosphere could be detected by measuring the acceleration of He_3^+ ion produced from the β-decay of tritium gas released at low F-region altitudes in the form of a neutral cloud. A numerical example is given, which shows that detectable fluxes of He_3^+ ions (with energies between 10 eV and 1 keV, depending on the strength of the assumed parallel electric field) could be obtained at 1200 km altitude from the release of ~5 g of tritium at 200 km altitude. (auth)

18262 IONOSPHERIC IMPLICATIONS OF RECENT LABORATORY DETERMINATIONS OF ELECTRON TEMPERATURE RELAXATION RATES. Dean, A. G.; Smith, D. (Birmingham Univ., Eng.). J. Atmos. Terr. Phys.; 37: No. 11, 1419-1422 (Nov 1975).

Ionospheric implications of recent laboratory measurements of electron temperature (T_e) relaxation rates in plasmas containing molecular oxygen and nitrogen are considered. The results indicate that below a "threshold" T_e of approximately 1300 K the dominant T_e relaxation mechanism throughout the ionospheric regions considered is the collisional excitation of the rotational states of molecular nitrogen, whereas for $T_e \gtrsim$ 1300 K an important contribution due to the onset of vibrational excitation of N_2 should result. These general deductions are in accord with theoretical expectations, but important differences are found in the magnitudes of the relaxation rates and in the value of the above threshold T_e. The laboratory measurements indicate that rotational excitation of O_2 is expected to play only a minor role in this relaxation process, contrary to the inferences made from previous laboratory studies, although a contribution due to the vibrational excitation of O_2 cannot be ruled out. (auth)

18263 KINETICS OF ELECTRONS IN A LOW-TEMPERATURE MOLECULAR PLASMA (IONOSPHERE). Gurevich, A. V.; Milikh, G. M.; Shlyuger, I. S. Zh. Eksp. Teor. Fiz.; 69: No. 5, 1640-1653(Nov 1975). (In Russian).

Solutions of the kinetic equation for electrons in a low temperature molecular plasma are obtained. Expressions for the electron distribution function in a alternating electric field are analyzed for both stationary conditions and for nonstationary perturbation and relaxation. Interaction between an intense radio pulse and continuously emitted radio wave in the lower ionosphere is investigated experimentally. It is found that the characteristic time of heating of the plasma by a powerful pulse is by an order of magnitude smaller than the relaxation time of the perturbation. The experimental results are shown to be in agreement with the theory. Kinetic parameters of the ionosphere plasma are determined. (auth)

18264 SHAPE OF INHOMOGENEITIES AND THEIR DRIFT DETERMINED FROM THE SCINTILLATIONS OF SIGNALS OF A GEOSTATIONARY SATELLITE. Triskova, L. (Inst. of Geophysics, Prague). Geofys. Sb.; 20: No. 363-396, 531-540(1972).

A description is given of an employment of correlation analysis in the determination of the characteristics of ionospheric inhomogeneities which are responsible for the scintillations in the satellite signals. Temporal and spatial correlations involving the square of the amplitude in the electromagnetic radiation emitted by the satellite provide a basis for the determination of the direction and the velocity of the considered motion of inhomogeneities. (IAA)

18265 POSSIBILITY OF DETERMINING THE HEIGHT OF OCCURRENCE AND CHARACTERISTIC DIMENSION OF IONOSPHERIC INHOMOGENEITIES FROM THE SCINTILLATION OF SIGNALS OF A GEOSTATIONARY SATELLITE. Triskova, L. (Inst. of Geophysics, Prague). Geofys. Sb.; 20: No. 363-396, 541-548(1972).

18266 IONIZATION OF THE LOWER IONOSPHERE BY X-RAYS AND OTHER IONIZATION SOURCES. Lastovicka, J. (Inst. of Geophysics, Prague). Geofys. Sb.; 20: No. 363-396, 549-563(1972).

The investigation reported is a continuation of a study of the role of hard X rays in the lower-ionosphere ionization conducted by Lastovicka (1970), Triska and Lastovicka (1970), and Lastovicka and Smilauer (1971). It is attempted to confirm conclusions reached on the basis of the earlier experiments and to select the most realistic of various NO-concentration height profiles. The X-ray control of ionospheric absorption is discussed along with questions concerning an ionization by hard X rays. (IAA)

18267 OBSERVATIONS OF THE ELECTRON CONTENT AND THE IONOSPHERIC SLAB THICKNESS IN PANSKA VES IN THE YEARS 1965 TO 1966. Blahak, F. (Inst. of Geophysics, Prague). Geofys. Sb.; 20: No. 363-396, 565-571(1972).

18268 EFFECT OF SOLAR ACTIVITY ON THE IONIZATION OF THE SPORADIC E LAYER ABOVE THE PRUHONICE OBSERVATORY. Perglerova, P. (Inst. of Geophysics, Prague). Geofys. Sb.; 20: No. 363-396, 573-576(1972).

18269 PROBLEM OF IONOSPHERIC TILTS. Mrazek, J. (Inst. of Geophysics, Prague). Geofys. Sb.; 20: No. 363-396, 577-585(1972).

An investigation is conducted concerning the effect of ionospheric tilts on the propagation of short-wave radio signals, taking into account data involving 135 selected transmitters which were regularly monitored during the period from September 1, 1970 to December 31, 1971. The transmitters selected represent various short-wave frequency bands, different directions and distances, and various time zones. (IAA)

18270 RELATIONSHIP BETWEEN SUDDEN IONOSPHERIC DISTURBANCES AND THE MAGNETIC STRUCTURE OF SUNSPOT GROUPS. Song, M. T. (Purple Mountain Observatory, Sinkiang, China). Tzu Tung Hua Hsueh Pao; 15: 159-172(Oct 1974). (In Chinese).

18271 VARIATIONS IN THE SOLAR ACTIVITY AND THE RADIOCARBON ABUNDANCE IN THE EARTH'S ATMOSPHERE. Dergachev, V. A. (Ioffe Inst. of Physics and Tech., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 70-76(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 325-333(1975).

Measurements of the C^{14} abundance in samples of known age over the past 300 years are carried out in an effort to determine the relationship between various solar activity cycles and the radiocarbon abundance in the earth's atmosphere. (auth)

18272 COSMIC RAY PION–NUCLEON FLUX RATIO IN THE ATMOSPHERE. Battacharyya, D. P.; Basu, D. (Indian Inst. for Cultivation of Science, Calcutta). J. Phys., G (London); 1: No. 8, L63-L65(21 Oct 1975).

Using a Bose-type distribution for $p + p \rightarrow \pi^- + x$ reactions in ISR experiments at a center of mass energy of 53 GeV, the cosmic ray pion-nucleon flux ratio in the atmosphere is estimated. The invariant pion-nucleon flux ratio yields an expression linking the temperature dependence and the energy. (UK)

18273 SOLAR PROTONS ON CLOSED MAGNETOSPHERIC FIELD LINES AFTER AN INTERPLANETARY FLUX DECREASE. Scholer, M. (Max-Planck-Institut fuer Physik und Astrophysik, Garching, Ger.). Planet. Space Sci.; 23: No. 10, 1445-1450(Oct 1975).

Particle measurements from the low altitude polar-orbiting satellite GRS-A/Azur and from Explorer 41 in the magnetosheath during a time period after the sudden commencement at 14:30 UT on 8 March 1970, have been used in order to study the access mode of solar particles into the closed field line region of the magnetosphere. A particle decrease in the magnetosheath and over the central polar cap but not in the stable trapping region indicates that solar particles are temporarily trapped and can complete several drifts around the Earth. A single loss cone distribution ~2° inside of the stable trapping region cannot be

explained by strong pitch angle scattering but is probably due to non-adiabatic particle motion. (auth)

18274 CALCULATED COSMIC RAY PION AND PROTON FLUXES AT SEA LEVEL. O'Brien, K. (Atomic Energy Commission Health and Safety Lab., New York). J. Phys., A (London); 8: No. 9, 1530-1534(Sep 1975).

A critical analysis is made of recent calculations of the sea level cosmic ray proton and pion spectra expected at ground level and comparison is made with two sets of experimental data measured at Durham. Particular attention is directed towards the theoretical approach advanced by the present author in a previous paper and some misconceptions by Hook and Turver are pointed out. The work of Jabs is also considered. It is concluded that all three sets of calculations represent the data equally well. (auth)

18275 EASTWARD ELECTROJET IN THE DAWN SECTOR. Rostoker, G.; Hron, M. (Univ., Alberta, Edmonton). Planet. Space Sci.; 23: No. 10, 1377-1389(Oct 1975).

Many previous researchers have shown that convection in the magnetosphere is reflected in the ionosphere by an eastward electrojet in the evening sector and a westward electrojet in the post-midnight sector. In this paper the existence of eastward electrojet flow in the dawn sector in the latitude regime normally occupied by the westward convection electrojet is demonstrated. It is shown that the convection westward electrojet near dawn may co-exist with the eastward electrojet while lying poleward of it. It is suggested that this eastward electrojet consists of Pedersen current flow driven by an eastward electric field and it is shown that the field lines which penetrate the eastward electrojet are populated by energetic electrons normally associated with the plasma sheet as well as high energy electrons normally associated with the trapped particle population. The high conductivity channel is generated by processes associated with the precipitation of high energy (E > 20 keV) electrons drifting eastwards from midnight in the trapping region. It is further shown that anti-parallel current sheets may flow on the magnetic lines of force penetrating the electrojet, and that this flow is closed in the ionosphere by Hall currents flowing equatorward in the high conductivity channel. (auth)

18276 THE EFFECT OF ELECTRIC FIELDS AND ION-NEUTRAL COLLISIONS ON THOMSON SCATTER SPECTRA. Swift, D.W. (Geophysical Institute, University of Alaska, Fairbanks, Alaska 99701). J. Geophys. Res. 80: No. 31, 4380-4382 (1 Nov 1975).

During disturbed periods the incoherent scatter spectra obtained from the Chatanika radar, located in the auroral zone, are asymmetric, showing evidence of nonequilibrium distributions of ion velocities. Model calculations using a simple relaxation model for ion-neutral collisions in the presence of a strong electric field reproduce the qualitative features of the observed return spectra. (auth)

18277 EVIDENCE FOR PRECIPITATION OF ENERGETIC PARTICLES BY IONOSPHERIC 'HEATING' TRANSMISSIONS. Wright, J.W. (Space Environment Laboratory, Environmental Research Laboratories, NOAA, Boulder, Colorado 80302). J. Geophys. Res. 80: No. 31, 4383-4386 (1 Nov 1975).

On the infrequent occasions when the Platteville, Colorado, 10-MW transmitter radio frequency matched the *F* region peak plasma frequency, intense sporadic *E* layers occurred at low altitudes (<95 km). After exclusion of various alternatives it is concluded that energetic particle precipitation from the plasmasphere may occur under these circumstances. (auth)

18278 AURORAL ENERGY INPUT FROM ENERGETIC ELECTRONS AND JOULE HEATING AT CHATANIKA. Wickwar, V.B.; Baron, M.J. (Stanford Research Institute, Menlo Park, California 94025); Sears, R.D. J. Geophys. Res. 80: No. 31, 4364-4367 (1 Nov 1975).

With the incoherent scatter radar at Chatanika, Alaska, a wide variety of measurements can be made related to the ionosphere, magnetosphere, and neutral atmosphere. A significant parameter is the amount of energy transferred from the magnetosphere into the ionosphere and neutral atmosphere during periods of auroral activity. In this report we examine a procedure whereby the incident energy flux of auroral electrons is ascertained from radar measurements. As part of the process we compare radar-determined fluxes with those ascertained from simultaneous photometric observations at 4278 Å. The fluxes obtained by both techniques had similar magnitudes and time variations. If we assume that the largest uncertainty in the radar/photometer comparison is the effective recombination coefficient, then that coefficient can also be deduced. We find a value 3×10^{-7} cm^3/s at about 105 km, which is in good agreement with other recent determinations during active auroral conditions. We then combine this technique with one to ascertain the Joule heating to determine the energy input from the magnetosphere to the ionosphere in a region localized above the radar on March 22, 1973, in the midnight sector. The energy input is continuous at a significant level, i.e., greater than the 3 ergs/cm^2 s that could be delivered by the sun, were it overhead. Moreover, at times, each of these inputs became as great as 30 ergs/cm^2 s. (auth)

18279 ELECTRIC FIELD MEASUREMENTS ABOVE A RADAR SCATTERING VOLUME PRODUCING 'DIFFUSE' AURORAL ECHOES. Tsunoda, R.T. (Radio Physics Laboratory, Stanford Research Institute, Menlo Park, California 94025). J. Geophys. Res. 80: No. 31, 4297-4306 (1 Nov 1975).

A coordinated experiment was conducted on March 7, 1972, in which electric fields, the mean *E* region neutral wind velocity, and the electron density profile were obtained in the vicinity of a radar scattering volume producing diffuse auroral echoes. The measurements were made by the Chatanika incoherent scatter radar, from the motions of barium ion clouds released by a NASA rocket. These plasma parameters were compared with the Doppler velocity maps obtained by a scanning auroral backscatter radar located at Homer, Alaska. From a threshold analysis of the data we show that the diffuse auroral echoes observed were not produced by primary plasma waves generated by the Buneman-Farley two-stream instability. (auth)

18280 NARROW BAND VLF ELECTROMAGNETIC SIGNALS GENERATED IN THE AURORAL IONOSPHERE BY THE HIGH-FREQUENCY TWO-STREAM INSTABILITY. Ungstrup, E. (Danish Space Research Institute, Lyngby, Denmark). J. Geophys. Res. 80: No. 31, 4272-4278 (1 Nov 1975).

Narrow band VLF signals with a structure similar to that of chorus were observed on a rocket payload launched from ESRANGE (European Space Range) near Kiruna, Sweden. The payload penetrated a proton glow aurora and flew over an auroral arc. It is shown that the signals which occurred in the frequency range 3.0–3.4 kHz probably are generated in the lower ionosphere, and the high-frequency two-stream instability developed by K. Lee et al. (1971) is suggested as the generation mechanism. (auth)

18281 INVESTIGATIONS IN THE IONOSPHERE ON KOSMOS 378. I. Objectives and Methods. Gringauz, K. I.; Gdalevich, G. L. (Inst. of Space Research, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 795-799(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 937-943(1974).

The Kosmos-378 satellite with a perigee of 240 km, an apogee of 1779 km, and an inclination of 74° was designed to investigate the global characteristics of the ionosphere, the density and temperature of ionospheric plasma particles, and their relation with precipitating charged particles of various energies. The experiments performed on Kosmos 378 are compared with the experiments of other Soviet and foreign satellites. An example is presented of the results obtained simultaneously by the set of scientific instruments during satellite passes through the southern polar cusp at altitudes of 1500–1750 km. (auth)

18282 INVESTIGATIONS IN THE IONOSPHERE ON KOSMOS 378. II. Spatial Distribution and Temporal Variations of Protons With an Energy $E_p > 1$ MeV. Gotselyuk, Yu. V.; Kuznetsov, S. N.; Logachev, Yu. I.; Stolpovskii, V. G. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 800-807(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 944-954(1974).

The spatial distribution and temporal variations of protons with $E_p \sim 1$–8 MeV in the ionosphere are investigated. It is found that proton fluxes at L > 3 experience considerable temporal variations, especially during substorms. The angular distribution of energetic protons becomes isotropic and these protons precipitate at L > 3 on the night side during the substorm maximum. (auth)

18283 CHARACTERISTICS OF THE EFFECT ON THE IONOSPHERE OF LOW-ENERGY SOLAR COSMIC RAYS AND PRECIPITATING PARTICLES. Dorman, L. I.; Dorman, I. V.; Krupitskaya, T. M. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 815-819(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 964-969(1974).

Analytical expressions are obtained that determine the rate of ion production in the atmosphere by fluxes of low-energy precipitating particles or solar cosmic rays with different charges Z. Account is taken of the fact that as the energy of the particles decreases as they are penetrating into the atmosphere their energy losses through ionization are not determined by the Bethe-Bloch formula. Allowance is also made for the fact that after crossing a maximum, the energy losses through ionization do not increase, but decrease as particle velocity decreases. The formulas obtained also allow for the gradual decrease in effective particle charge as a result of the capture of orbital electrons. (auth)

18284 THEORETICAL MODELS OF SEASONAL ELECTRON DENSITY VARIATIONS IN THE MID-LATITUDE F_2 REGION. II. Fatkullin, M. N. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 820-823(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 970-974(1974).

Theoretical models of seasonal electron density variations in the mid-latitude F_2 region that allow for the effect of thermospheric winds and the combined effect of these winds and electric fields are examined. The manifestation of the seasonal anomaly in the parameters of the F_2-layer maximum and the daily vertical development of the anomaly are studied. (auth)

18285 EFFECTS IN THE F REGION DURING SUDDEN IONOSPHERIC DISTURBANCES. Kozlov, S. I.; Kudryavtsev, V. P.; Pedorenko, V. F.; Strelkov, A. S. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 824-826(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 975-978(1974).

The behavior of the F region during sudden ionospheric disturbances is examined. The possibility is demonstrated, in principle, of an increase in the ion production rate at these heights by a factor of approximately 1.5-4 compared to normal conditions. (auth)

18286 EFFECT OF DYNAMIC PROCESSES ON THE DAILY ELECTRON DENSITY VARIATIONS IN THE F REGION. Korsunova, L. P.; Durneva, L. A. (Simetrian Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Novosobirsk, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); No. 6, 827-830(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 979-983(1974).

The continuity equation for electron density is solved with allowance for the motion term under various assumptions regarding the nighttime ionization sources. It is presumed that the vertical transport of charged particles is produced by a time variable neutral wind in the presence of a magnetic field. Allowance is made for the variations of the scattered geocoronal emission with solar zenith distance. A model of daily electron density variations in the height interval of 90-150 km is constructed. (auth)

18287 VARIATIONS IN THE ELECTRON DENSITY OF THE E LAYER. Givishvili, G. V.; Fligel, M. D. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 831-835 (1974).

Translated from Geomagn. Aeron.; 14: No. 6, 984-989(1974).

The relation between the index of the frequency dependence of absorption during vertical sounding and the electron density gradient is investigated. It is shown that the half-thickness of the E layer experiences semi-annual variations with a maximum during the equinox and that their amplitude increases toward high latitudes in years of moderate and high solar activity. (auth)

18288 SOME PARAMETERS OF WAVELIKE DISTURBANCES IN THE E LAYER. Krasnov, V. M. (Ionospheric Sector, Alma-Ata, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 836-838(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 990-993(1974).

From simultaneous measurements of the amplitude and Doppler shift of the frequency of a continuous signal it follows that wavelike electron density disturbances with periods of 174 and ~560 sec occur in the E-layer region. (auth)

18289 DETERMINATION OF THE ELECTRON DENSITY PROFILE OF THE LOWER IONOSPHERE FROM SURFACE RADIO WAVE FIELDS WITH ALLOWANCE FOR A POSSIBLE IONIZATION VALLEY. Krasnushkin, P. E.; Fedorov, E. N. (Inst. of Mathematics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 839-846(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 994-1002(1974).

A method is proposed for determining the electron density profile N(h) of the lower ionosphere from the dependence of the amplitude of the surface radio wave field on distance measured on several frequencies in the LF and VLF range. This method is used to refine the summer daytime profiles of the C and D layers. The problem of the ionization valley between the C and D layers is clarified. (auth)

18290 SOME ANOMALIES OF REGULAR ABSORPTION IN THE POLAR IONOSPHERE. Lukashkin, V. M. Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 847-850(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1003-1007(1974).

The daily and seasonal variations of regular cosmic noise absorption on a frequency of ~30 MHz in the polar ionosphere are investigated. It is shown that, along with regular variations, absorption intensity has a semidiurnal and semi-annual asymmetry, whose magnitude depends on the season and whose sign depends on the hemisphere. (auth)

18291 INVESTIGATION OF THE GLOBAL PROPERTIES OF IONOSPHERIC WAVEGUIDES. I. Tsedilina, E. E. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 851-854(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1008-1012(1974).

The ionospheric waveguides F, E, FE, and D, appearing during long-distance HF propagation, are classified. (auth)

18292 COMPUTATION OF THE CHARACTERISTICS OF MULTIRAY HF PROPAGATION OF MODELS. Barabashov, B. G.; Kalyadin, B. G.; Remidovskaya, T. N. (Rostov-on-the-Don State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 855-858(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1013-1018(1974).

The main characteristics of multiray propagation are computed for models of the ionosphere corresponding to the daytime in winter during maximum and minimum solar activity. The results of the computations can be used as a forecast of multiray HF propagation of single-hop paths up to 3000 km long. (auth)

18293 EFFECT OF SOME CHARACTERISTICS OF THE HIGH-LATITUDE IONOSPHERE ON THE RADIO-WAVE TRAJECTORY. Boyarintsev, E. L.; Yashin, Yu. Ya. (Polar Geophysical Inst., Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 859-862(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1019-1023(1974).

The results are presented of an experiment in recording angles of arrival on the Murmansk–Salekhard auroral radio path. It was found that when signals are recorded simultaneously at the two ends of the path as it lies in the auroral disturbance zone, the deviations of the bearings from the arc of the great circle that connects the ends of the path can have different signs. A model of the spatial distribution of electron density is proposed, which makes it possible to explain the given effect. Numerical estimates of the deviations are presented in the framework of the selected model. (auth)

18294 NATURE OF SIGNAL FADINGS DURING VARIOUS MODES OF RADIO-WAVE PROPAGATION. Kerblay, T. S.; Nosova, G. N.; Allaberdyeev, D.; Porosnaya, A. P. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 863-865(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1024-1027(1974).

The modes of radio wave propagation on three radio paths 1000 and 2500 km long are analyzed and their corresponding field values and signal fading characteristics are determined. It is shown that the fading frequency depends significantly on the mode of propagation. (auth)

18295 DUCTING OF LOW-FREQUENCY ELECTROMAGNETIC WAVES (WHISTLERS). Yashin, Yu. Ya. (Gorky State Univ., USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 866-871(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1028-1034(1974).

The possibility is demonstrated for ducts to form during the propagation of low-frequency waves in a medium with a monotonically varying electron density and an external magnetic field without and with allowance for disturbances of these parameters. Some dispersion properties of signals propagating in such ducts are investigated. (auth)

18296 FORMATION AND PROPAGATION OF DAYTIME WHISTLERS TO DISTANCES OF AS MUCH AS 500 km. Zabavina, I. N.; Shtennikov, Yu. V. (Leningrad State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 872-875(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1035-1039(1974).

The formation of the space-time structure of whistlers as they propagate in the earth–ionosphere waveguide during the daytime is investigated. The characteristics of formation of various types of whistlers as a result of the interference of the ground and ionospheric waves are shown. (auth)

18297 PHOTOELECTRON FLUXES AT HEIGHTS OF 100 TO 300 km. Popov, G. V.; Khazanov, G. V. (Inst. of Terrestrial Magnetism, Ionosphere, and Radiowave Propagation, Novosibirsk, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 876-879(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1040-1044(1974).

A numerical solution of the kinetic equation for the photoelectron spectrum in the energy interval $1 \text{ eV} \leq E \leq 230 \text{ eV}$ at heights of 100-300 km is presented on the basis of computed primary electron spectra. The vertical, seasonal (for the latitude of Irkutsk), and latitudinal variations of photoelectron spectra around noon local time are obtained. (auth)

18298 DYNAMICS OF AURORAL ELECTRONS IN THE ATMOSPHERE. Osipov, N. K. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 884-888(1974)

Translated from Geomagn. Aeron.; 14: No. 6, 1050-1055(1974).

The Fokker-Planck equation is solved for a flux of accelerated electrons in the atmosphere. The structure of the geomagnetic field is found to affect the height dependence of the rate of energy

release. The rate of evolution of pitch-angle distributions in the atmosphere is investigated for various electron energies. Albedo electrons are estimated for $\Phi = 72°$ as a function of the characteristic energy and height of penetration of electrons into the atmosphere. (auth)

18299 RELATION BETWEEN THE INTENSITY VARIATIONS AND ROTATIONAL TEMPERATURE OF THE HYDROXYL EMISSION OF THE NIGHT SKY. Potapov, B. P. (Inst. of Atmospheric Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 889-892(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1056-1060(1974).

The relation between the intensity of hydroxyl emission and the temperature of the surrounding medium during adiabatic processes is analyzed with allowance for the newest constants of major chemical reactions. The relation between the rotational temperature of atmospheric hydroxyl and the temperature of the surrounding medium at various rotational levels is analyzed. (auth)

18300 LUMINANCE OF THE SKY IN THE REGION OF THE 1.27-μ EMISSION BAND OF MOLECULAR OXYGEN AS OBSERVED FROM HEIGHTS UP TO 30 km. Fedorova, E. O.; Lobanova, G. I.; Semenova, V. I. Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 893-895(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1061-1064(1974).

Data are obtained on the relation between luminance produced by the emission of molecular oxygen and that of scattered radiation at heights to 30 km on the basis of measurements of sky luminance near 1.27 μ. The relation between the intensity of oxygen emission observed from a height of 30 km and the solar zenith angle is also obtained. The measurements were made in the summers of 1971-1973 at 51.6°N with a stratospheric-balloon spectrometer having a spectral resolution of 0.038-0.056 μ. (auth)

18301 DIRECTIONAL INTENSITY OF THE MUON COMPONENT OF COSMIC RAYS AT VARIOUS HEIGHTS. Blokh, Ya. L.; Dorman, L. I.; Libin, I. Ya.; Yanke, V. G. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 922-924(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1096-1098(1974).

The angular distribution of the muon component has been studied fairly closely at sea level and at small depths underground. However, the angular dependence of cosmic-ray intensity at various heights has not been studied sufficiently. An attempt is made here to obtain the height dependence. (auth)

18302 NATURE OF THE SPORADIC IONIZATION OF THE E LAYER OF THE MID-LATITUDE IONOSPHERE IN THE COURSE OF A SUBSTORM. Aleksandrova, I. A. (Leningrad State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 929-931(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1103-1106(1974).

The behavior of sporadic E-layer ionization in the polar region during a substorm is analyzed. To determine the general picture of the dynamics of ionization for selected substorms, the space-time distribution of E_s is mapped in the night sector from vertical ionospheric soundings at high-latitude stations. A list of the Stations and the number of substorms n examined for each are given in Table 1. (auth)

18303 LONGITUDINAL EFFECT IN THE DISTRIBUTION OF ELECTRON DENSITY AND OF INTEGRAL TRANSVERSE CONDUCTIVITY OF THE EQUATORIAL IONOSPHERE. Kadukhin, G. F.; Soboleva, T. N. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 931-933(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1107-1108(1974).

The vertical distributions of N_e, $\sigma_\perp$, and $\sigma_\wedge$ and the values of Σ_P and Σ_H at Huancayo and Thumba, which lie along the geomagnetic equator near the maximum and minimum of the daytime electrojet are analyzed. To estimate the longitudinal effect proper, the conditions during the equinox (March 18, 1965) are investigated, when both stations are equally illuminated by the sun. The electron density distributions at Huancayo and Thumba are shown in Fig. 1. This figure was obtained by computing the N(h) profiles at 12h LT from vertical sounding ionograms using an analog computer. (auth)

18304 EXPERIMENTAL PROOF OF THE MODEL OF A LARGE-SCALE REFLECTING SCREEN. Beskorovaynaya, L. I.; Drobzhev, V. I.; Kudelin, G. M.; Nurgozhin, B. I.; Pelenitsyn, G. M.; Troitskii, B. V. (Ionospheric Sector, Alma-Ata, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 933-934(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1109-1110(1974).

The inhomogeneous structure of the ionosphere is investigated by the spaced reception method with a small base. The method for determining the horizontal velocity component, the period, and the wavelength of a disturbance is developed. (BJG)

18305 MAGNETIC-IONOSPHERIC EFFECT OF A SUBSTORM. Yudovich, L. A.; Goncharova, E. E.; Pushkova, G. N. (Inst. of Terrestrial Magnetism, Ionosphere, and Radio-Wave Propagation, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 935-937(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1111-1112(1974).

The substorm on December 16, 1964, is investigated. Sources of the disturbance are discussed. It is concluded that magnetic field variations proceed independently of the variations of electric fields in the ionosphere that are responsible for vertical movements of ionization. (BJG)

18306 ELECTRIC FIELDS AND CURRENTS IN THE LOW-LATITUDE ENVIRONMENT OF THE EARTH'S TERMINATOR. Krylov, A. L. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 937-938(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1113-1114(1974).

The potentials and stream function that determine the field and currents to both sides of the low-latitude environment of the terminator are found. Only the general solution of the problem in the morning environment of the terminator for the daytime region and in the evening environment for the nighttime region is determined. (BJG)

18307 DETERMINATION OF THE COEFFICIENT OF ATTACHMENT OF ELECTRONS TO ATMOSPHERIC OXYGEN BY METEOR METHODS. Bibarsov, R. Sh. (Inst. of Astrophysics, Alma-Ata, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 939-940(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1115-1116(1974).

The atmospheric attachment rate can be determined from ionized trails formed by evaporation of iron meteoroids in the earth's atmosphere. The observed attachment rate, then, is practically caused by atmospheric oxygen. (BJG)

18308 PULSATING INHOMOGENEITIES OF THE λ 5577 A EMISSION AND INTERNAL GRAVITY WAVES. Korobeynikova, M. P.; Nasyrov, G. A. (Inst. of Terrestrial and Atmospheric Physics, Ashkhabad, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 940-942(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1116-1117(1974).

Spatial inhomogeneities are a typical feature of the green line emission of atomic oxygen, λ 5577 Å. The properties of these inhomogeneities are investigated on the basis of observations on a multichannel scanning electrophotometer at the observatory in Vannoyskiy village in 1964-1967. (auth)

18309 CORRELATION BETWEEN THE PARAMETERS OF THE HYDROXYL EMISSION OF THE UPPER ATMOSPHERE. Babakov, N. A. (Inst. of Terrestrial and Atmospheric Physics, Ashkhabad, USSR). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 942-944(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1118-1119(1974).

The generation mechanism of hydroxyl emission is discussed. The presence or absence of a correlation between I_{OH} and T_{rot} presupposes a corresponding mechanism: either the O_3-H or the O_2-H reaction. (BJG)

18310 MOMENTUM AND ZENITHAL DEPENDENCE OF THE ENHANCEMENT IN THE INTENSITIES OF HIGH-ENERGY COSMIC RAY MUONS NEAR SEA LEVEL. Choate, L. M. College Station, TX; Texas A and M University. (1975). 180p. University Microfilms Order No. 75-25,086.

Thesis (Ph. D.).

The absolute directional differential intensities of high-energy cosmic ray muons near sea level have been measured over the momentum range 2-700 GeV/c and the zenithal range 55^0 to 90^0. These measurements were obtained from data accumulated in the geomagnetic west by use of the AMH magnetic momentum spectrometer-telescope. Details of the experimental apparatus as well as the data analysis procedure are presented. The muon charge ratio as a function of momentum and zenith angle in the geomagnetic west is presented and found to be in good agreement with theoretical predictions. The enhancement in the muon intensities as a function of momentum and zenith angle is presented and compared to the Maeda-Cantrell theoretical model for the production and propagation of high-energy cosmic ray muons within the earth's atmosphere. The enhancement measurements presented are perhaps the most accurately determined enhancements to date and are found to be in good agreement with the theoretical model for momenta less than 70 GeV/c. At higher momenta the results are inconclusive but suggest a departure from the theory. (Diss. Abstr. Int., B)

18311 IONOSPHERIC MODIFICATION INDUCED BY HIGH-POWER HF TRANSMITTERS: A POTENTIAL FOR EXTENDED RANGE VHF-UHF COMMUNICATIONS AND PLASMA PHYSICS RESEARCH. Utlaut, W. F. (Dept. of Commerce, Boulder, CO). Proc. IEEE (Inst. Electr. Electron. Eng.); 63: No. 7, 1022-1043 (Jul 1975).

When the ionized upper atmosphere of the earth is illuminated by high-power HF radio waves at appropriate frequencies, the temperature of electrons in the ionosphere can be raised substantially. In addition, radio waves with sufficient energy cause parametric instabilities that generate a spectrum of intense plasma waves. Observations of these phenomena have produced new understanding of plasma processes. One consequence of heating and plasma wave generation is that irregularities are formed in the electron distribution which are aligned with the earth's magnetic field. Because of this, a scatterer of large radar cross section is produced, which scatters HF through UHF communication signals over long distance paths, that would not otherwise be normally possible by ionospheric means. Results of radio, radar, communication, and photometric experiments that explored the characteristics of the volume of ionosphere which has been intentionally modified, temporarily, above facilities near Boulder (Platteville), Colo., and at Arecibo, Puerto Rico are summarized. (auth)

18312 SOLAR ZENITH ANGLE VARIATION OF D-REGION IONIZATION. Ratnasiri, P. A. J. Urbana, IL; Univ. of Illinois (1975). 291p. University Microfilms Order No. 75-24,388.

Thesis (Ph. D.).

A review of the D-region ionization measurements and its solar zenith angle variation reveals that a unified model of the D region, incorporating both the neutral chemistry and the ion chemistry, is required for a proper understanding of this region of the ionosphere. Model calculations are carried out with a view to interpreting the solar zenith angle variation of D-region ionization as measured on July 24, 1968 at Wallops Island. All input data are taken corresponding to this day. The model developed for the neutral chemistry includes the transport terms relating to molecular and eddy diffusion. In the ion chemistry model, ion-pair production rates are calculated for solar x-rays between 1 A and 100 A, EUV radiations from 100 A up to the Lyman-alpha line, precipitating electrons and galactic cosmic rays. A comparison of the computed electron-density profiles with the rocket measured profiles reveals that good overall agreement is obtained when the neutral chemistry model associated with the low eddy diffusion coefficient values is used. The computed solar zenith angle variation, however, is only a fraction of the measured variation. This discrepancy is probably due to short-term variations in the mesopause temperatures and x-ray fluxes below 3 A. (Diss. Abstr. Int., B)

Effects of Nuclear Detonations

18313 THE PRODUCTION OF NITROGEN OXIDES BY LOW-ALTITUDE NUCLEAR EXPLOSIONS. Gilmore, F.R. (R & D Associates, Marina del Rey, California 90291). J. Geophys. Res. 80: No. 33, 4553-4554 (20 Nov 1975).

Hydrodynamic and chemical kinetic calculations are used to show that megaton (Mt) nuclear explosions near the ground produce, in the air that is shocked above 2200°K and quickly cooled by expansion, 0.8×10^{32} NO molecules/Mt. Inside this region the air is still so hot that further production or destruction of NO may take place. An upper limit to the production is obtained by assuming that the hot inner air mixes with undisturbed air, producing an additional 0.7×10^{32} NO molecules/Mt, giving a total of 1.5×10^{32} NO molecules/Mt. A lower limit is obtained by assuming that during the fireball rise all of the shocked air containing NO is entrained and mixed into the hotter air, and slow cooling of the mixture reduces the total NO to 0.4×10^{32} molecules/Mt. (auth)

Magnetospheric Phenomena

Refer also to abstracts 18122–18124, 18161, 18278, and 18318.

18314 NEW PLASMA REGIME IN THE DISTANT GEOMAGNETIC TAIL. Hardy, D. A.; Hills, H. K.; Freeman, J. S. (Rice Univ., Houston, TX). Geophys. Res. Lett.; 2: 169-172(May 1975).

Observations are reported of an extensive region of low-energy plasma particles (LEP) flowing antisunward along the ordered field lines in the lobes of the geomagnetic tail at lunar distances. The flow was detected by three suprathermal ion detectors deployed on the lunar surface during the Apollo 12, 14, and 15 missions. This particle regime is found to be similar to the "boundary layer" and "plasma mantle" observed at smaller geocentric distances and to an interior flow region parallel to the magnetopause in the dayside magnetosphere. It is located exterior to the plasma sheet across essentially the entire tail and adjacent to the magnetopause on both the dawn and dusk sides of the magnetosphere. Variations in the integral flux, temperature, and number density are described. It is suggested that this flow and the three similar regimes are simply connected along the inner surface of the magnetopause and are, in fact, the same phenomenon. (IAA)

18315 LONG PERIOD VARIATIONS OF THE GEOMAGNETIC FIELD IN CENTRAL EUROPE AND DISTRIBUTION OF THE ELECTRICAL CONDUCTIVITY. Pecova, J.; Praus, O. (Inst. of Geophysics, Prague). Geofys. Sb.; 20: No. 363-396, 449-464(1972).

The results are presented of an analysis of the spatial distribution of the D, H, and Z components of the geomagnetic field, taking into account data obtained by 13 observatories in Central and Western Europe. Spectral densities during the solar activity maxima were found to be significantly higher than those for the minimum activity period. The investigation of long-period variations of the geomagnetic components appears to provide important information about regional changes of the electrical conductivity in large-scale structural blocks. (IAA)

18316 SOME REGULARITIES OF THE OCCURRENCE OF GEOMAGNETIC $\pi2$ PULSATIONS. Strestik, J. (Inst. of Geophysics, Prague). Geofys. Sb.; 20: No. 363-396, 383-389(1972).

The repetition of the occurrence of $\pi2$ pulsations at short intervals during one day is discussed. The maximum occurrence of repetitive $\pi2$'s is in the evening between 20 and 22 hrs LT. The interval of repetition, on the average, amounts to 43 mins and decreases from evening to morning. The pulsations occurring in sequence display considerable similarity in period, amplitude, polarization and shape of the spectral density curve. The second part of the paper deals with the recurrence of $\pi2$'s in connection with the period of solar rotation. The recurrence period depends on the position of the considered year in the solar cycle and varies from 30 to 27 days. (auth)

18317 STRUCTURAL CHARACTERISTICS OF A GEOMAGNETIC STORM. Bouska, J. (Inst. of Geophysics, Prague). Geofys. Sb.; 20: No. 363-396, 369-382(1972).

The structural characteristics of geomagnetic storms are considered, taking into account the prestorm interval, the commencement of the storm and its phases, the pulsation characteristics of SSC, the positive compression phase, the main phase of a geomagnetic storm, the recovery phase, and the poststorm occurrence of micropulsations. It is found that a marked increase of the pulsation activity of the electromagnetic field of the earth is one of the typical features of a geomagnetic storm. (IAA)

18318 RADIATION BELT AND CONVECTION IN AN ARTIFICIAL MAGNETOSPHERE. Podgornyi, I. M.; Dubinin, E. M.; Potanin, Yu. N. (Inst. of Cosmic Studies, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 39: No. 2, 89-91(1975).

Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 39: No. 2, 350-353(1975).

It was shown previously that a magnetosphere with a radiation belt appears in the interaction of a magnetic dipole with a plasma flow whose properties are chosen in accordance with the principle of limited modelling. The radiation belt is filled on the night side. The electric fields were measured to check the assumption that the filling occurs by convection of closed lines of force of the magnetosphere on the night side. The electric-field profile found in these measurements agrees with this convection model. (auth)

18319 ECHO I: AN EXPERIMENTAL ANALYSIS OF LOCAL EFFECTS AND CONJUGATE RETURN ECHOES FROM AN ELECTRON BEAM INJECTED INTO THE MAGNETOSPHERE BY A SOUNDING ROCKET. Henrickson, R. A.; McEntire, R. W.; Winckler, J. R. (Univ. of Minnesota, Minneapolis). Planet. Space Sci.; 23: No. 10, 1431-1444(Oct 1975).

On 13 August 1970, a sounding rocket carrying a high voltage electron accelerator and several electron detectors was launched from Wallops Island, Virginia. Sixteen msec long, 70 mA pulses were injected into the magnetosphere at pitch angles near 90°. In each pulse the electron energy was modulated between 35 and 43 keV. The electrons were trapped in the Earth's magnetic field and bounced between the northern and southern conjugate points with a period of ~0.65 sec and drifted eastward with a gradient-curvature drift velocity of ~765m/sec. For about 90 seconds the rocket intercepted the returning echoes. Careful study of the rocket trajectory has allowed a partial space-time picture of an echo to be constructed. The bounce time and drift velocity observations are consistent with predictions based on internal magnetic field models with no electric fields. The flux has the spatial variations predicted by atmospheric scattering models at the southern conjugate point but is about a factor of 10 too low. After some injections delayed echoes are observed, apparently 40 keV electrons whose bounce time has been increased by ~75 msec, but with no change in their bounce averaged drift velocity. Study of detector response during gun pulses revealed

three unexplained features: a field aligned upward moving flux after downward injections; a downward moving, time dependent flux after injections at some upward pitch angles; a lack of altitude (or atmospheric density) dependence on observed count rates. (auth)

18320 AN EMPIRICAL RELATIONSHIP BETWEEN INTERPLANETARY CONDITIONS AND *Dst*. Burton, R.K.; McPherron, R.L.; Russell, C.T. (Institute of Geophysics and Planetary Physics, University of California, Los Angeles, California 90024). J. Geophys. Res. 80: No. 31, 4204-4214 (1 Nov 1975).

An algorithm is presented for predicting the ground-based *Dst* index solely from a knowledge of the velocity and density of the solar wind and the north-south magnetospheric component of the interplanetary magnetic field. The three key elements of this model are an adjustment for solar wind dynamic pressure, an injection rate linearly proportional to the dawn-to-dusk component of the interplanetary electric field which is zero for electric fields below 0.5 mV m^{-1}, and an exponential decay rate of the ring current with an e folding time of 7.7 hours. The algorithm is used to predict the *Dst* signature of seven geomagnetic storm intervals in 1967 and 1968. In addition to being quite successful, considering the simplicity of the model, the algorithm pinpoints the causes of various types of storm behavior. A main phase is initiated whenever the dawn-to-dusk solar magnetospheric component of the interplanetary electric field becomes large and positive. It is preceded by an initial phase of increased *Dst* if the solar wind dynamic pressure increases suddenly prior to the main phase. The recovery phase is initiated when the injection rate governed by the interplanetary electric field drops below the ring current decay rate associated with the ring current strength built up during the main phase. Variable recovery rates are generally due to additional injection during the recovery phase. This one algorithm accounts for magnetospheric behavior at quiet and at disturbed times and seems capable of predicting the behavior of *Dst* during even the largest of storms. (auth)

18321 UNSTEADY INTERACTIONS OF SOLAR WIND DISTURBANCES WITH THE MAGNETOSPHERE. Tamao, T. (Department of Physics and Astronomy, University of Denver, Denver, Colorado 80210). J. Geophys. Res. 80: No. 31, 4230-4236 (1 Nov 1975).

A model for unsteady interactions between solar wind disturbances and the magnetosphere associated with the southward shift of the solar wind magnetic field during the growth phase of substorms is presented. It is emphasized that the presence of the solar wind electric current relating to the southward turning of the magnetic field and its interaction with the magnetosphere are essential in describing the transient process that generates the large-scale magnetospheric convection. Conceptual discussion on the stress generation due to the interaction in the outermost part of the magnetosphere and its transport into the inner magnetosphere and the high-latitude ionosphere are given. In comparison with the fast transient process, for instance, ssc* of magnetic storms, the slow magnetosonic wave will play an essential role in the slow process, such as the early stage of the growth phase. By using the equivalent circuit model along with the above consideration the time response of the magnetosphere-ionosphere current system for this interaction is examined. The results indicate that a coupling of a rather large capacitance for the slow mode, in comparison with that for the Alfvén mode, with the ionospheric resistance can yield a long time delay for the saturation of the ionospheric current. (auth)

18322 CHARACTERISTICS OF THE MAGNETOPAUSE ENERGETIC ELECTRON LAYER. Meng, C.; Anderson, K.A. (Space Sciences Laboratory, University of California, Berkeley, California 94720). J. Geophys. Res. 80: No. 31, 4237-4243 (1 Nov 1975).

Three years of Imp 5 data show that the magnetopause layer of energetic electrons was present during 227 of 230 orbits over this period and extends along the magnetopause from geomagnetic latitudes as low as 40° to latitudes corresponding to the polar cap. It also exists at the boundary between the magnetosheath and the polar cusp region. The data show that the integral energy spectrum of these electrons ($E_e > 18$ keV) varies greatly with the planetary Kp index and hardens with increasing Kp values. The average spectrum can be represented by a power law $J(>E) \propto E^{-\alpha}$, where $\alpha = 1.94 \pm 0.19$. The intensity of the magnetopause layer electrons increases with increasing Kp values and also has a weak dependence on the magnitude of the north-south component of the interplanetary magnetic field. The energy density of the energetic electrons in this layer is of the order of 10^{-14} erg/cm³. (auth)

18323 DRIFT-FREE MAGNETIC GEOMETRIES IN ADIABATIC MOTION. Stern, D.P. (Theoretical Studies Group, Goddard Space Flight Center, Greenbelt, Maryland 20771); Palmadesso, P. J. Geophys. Res. 80: No. 31, 4244-4248 (1 Nov 1975).

There exist magnetic fields in which particles bouncing between mirror points experience no net first-order guiding center drift. In such fields, even though the instantaneous gradient and curvature drifts are not zero, their total effect integrated over any bounce period vanishes, so that particles merely wobble back and forth around fixed field lines. A class of two-dimensional drift-free fields, somewhat resembling the configuration found in the geomagnetic tail, is described; several proofs of the drift-free property are given, including some that suggest that the property of vanishing net drift might extend to nonadiabatic orbits. A general criterion for identifying drift-free fields is developed, and a case of motion in a nearly drift-free field is also investigated. The theory is applied to the plasma sheet in the earth's magnetotail, and observational evidence is presented suggesting that the magnetic field there indeed approaches a drift-free configuration. (auth)

18324 VLF LINE RADIATION IN THE EARTH'S MAGNETOSPHERE AND ITS ASSOCIATION WITH POWER SYSTEM RADIATION. Helliwell, R.A.; Katsufrakis, J.P.; Bell, T.F.; Raghuram, R. (Radioscience Laboratory, Stanford University, Stanford, California 94305). J. Geophys. Res. 80: No. 31, 4249-4258 (1 Nov 1975).

In a recent experiment, discrete VLF emissions from the magnetosphere were triggered by a transmitter at Siple Station in Antarctica. Spectrograms of these signals as received at the conjugate point, Roberval, Quebec, showed changes in slope, entrainments, and cutoffs at frequencies (several kilohertz) close to the harmonic induction lines from the local 60-Hz power system. This observation led to the suggestion that harmonic radiation from the power system enters the magnetosphere and interacts with the triggered emissions. New evidence supporting this suggestion has been found in spectrograms of simultaneous recordings made at Roberval and at Siple Station in Antarctica. It is shown that line radiation, near harmonics of 60 Hz, travels along the earth's magnetic field in the whistler mode and is received in the conjugate hemisphere at Siple Station. Echoing of the line radiation between Siple and Roberval is often observed. The magnetospheric lines are usually shifted in frequency by 20–30 Hz with respect to the adjacent induction line, but their spacings are near 120 Hz. They may trigger and cut off emissions as do signals from VLF transmitters. Occasionally, magnetospheric lines are seen with spacings of only 20–30 Hz. This smaller frequency separation and the frequency shift of other lines spaced 120 Hz apart are related to the positive frequency offset of emissions triggered by VLF signals from the Omega navigation transmitters. Harmonic lines of reasonable amplitude ($\sim 10^{-3}$ γ) are shown to enhance significantly the precipitation of 2-keV electrons over the eastern parts of the American continents near $L \sim 4$. Some mid-latitude hiss bands appear to consist of sets of magnetospheric lines and their associated triggered emissions. (auth)

18325 ELECTROSTATIC NOISE BANDS ASSOCIATED WITH THE ELECTRON GYROFREQUENCY AND PLASMA FREQUENCY IN THE OUTER MAGNETOSPHERE. Shaw, R.R.; Gurnett, D.A. (Department of Physics and Astronomy, University of Iowa, Iowa City, Iowa 52242). J. Geophys. Res. 80: No. 31, 4259-4271 (1 Nov 1975).

Naturally occurring noise bands near the electron plasma frequency are frequently detected by the University of Iowa plasma wave experiment on the Imp 6 satellite in the region from just inside the plasmapause to radial distances of about 10 R_E in the outer magnetosphere. The electric field strength of these noise bands is usually small with typical broad band electric field strengths of about 2 μV m^{-1}. A magnetic field has been detected only in a few unusually intense cases, and in these cases the magnetic field energy density is several orders of magnitude smaller than the electric field energy density. The bands are observed at all magnetic latitudes covered by the Imp 6 orbit ($|\lambda_m| \lesssim 45°$) and appear to be a permanent feature of the outer magnetosphere. They are found at all local times and occur least frequently in the quadrant from 18 to 24 hours. The bands appear to consist of two distinct spectral types which we have called diffuse and narrow band. In both types the center frequency of the noise band is bounded by consecutive harmonics of the electron gyrofrequency, and these noise bands occur most often between harmonics that are near the local electron plasma frequency. They appear to merge continuously into two other types of plasma wave emissions that are found in dissimilar regions of the magnetosphere (upper hybrid resonance noise, also called region 3 noise, inside the plasmasphere and $(n+1/2)$ f_g harmonics in the outer magnetosphere). It is suggested that this smooth merging is caused by changes in the plasma wave dispersion relation that occur as the spacecraft moves from the cold plasma within the plasmasphere into the warm non-Maxwellian plasma found in the outer magnetosphere. (auth)

18326 A SUBAURORAL AND MID-LATITUDE VIEW OF SUBSTORM ACTIVITY. Carpenter, D.L. (Radioscience Laboratory, Stanford University, Stanford, California 94305); Foster, J.C.; Rosenberg, T.J.; Lanzerotti, L.J. J. Geophys. Res. 80: No. 31, 4279-4286 (1 Nov 1975).

A substorm period near 0900 UT on January 2, 1971, provided both new and confirming evidence of mid-latitude and subauroral phenomena associated with magnetospheric substorm activity. Several of the principal ground and/or balloon observations were made near $L=4$ at the conjugate stations Siple, Antarctica, and Roberval, Canada. Satellite data were obtained from ATS 5, positioned at synchronous orbit roughly 2 hours to the west of the Siple-Roberval meridian. A key

feature of the substorm activity was the previously reported observation of correlated bursts of X rays and VLF noise. It has earlier been concluded that the VLF bursts and associated particle precipitation events were 'triggered' by whistlers entering the magnetosphere at $L\sim4$ outside but near the plasmapause. During the substorm period a widespread VLF phase anomaly (previously reported) was observed on subionospheric paths extending within the plasmasphere to $L\sim2.5$ and over much of North America. Conjugate ULF observations near $L=4$ revealed enhancements of noise power in the 8- to 128-s period range at times of individual substorm intensifications and also a large increase in noise power during the period of correlated X ray and VLF burst activity. Conjugate VLF observations revealed a series of noise bands at frequencies below 3 kHz, with durations of the order of 30 min and center frequencies generally rising with time. The onset of each band appeared to follow within less than 10 min a substorm intensification detected from ground magnetometers or ATS 5 energetic particle detectors. Cross-L inward drifts of whistler paths were observed in the outer plasmasphere during the substorm activity. The inferred westward electric field averaged about 0.35 mV/m during the hour before the observations of correlated X ray and VLF bursts. During this hour the plasmapause appears to have been displaced to a position slightly equatorward of Siple; in terms of resonance conditions along the field lines, the X ray detectors on the balloon over Siple were then in a favorable position to observe the results of magnetospheric wave-particle interactions involving electrons of energy greater than 30 keV. The various observed phenomena show promise of providing information on (1) the relations of ULF and VLF noise activity to the magnetospheric particle population at middle latitudes, (2) the injection and subsequent drift of low and medium energy electrons during substorms, and (3) enhanced particle precipitation deep within the plasmasphere during substorms. (auth)

18327 EXPLORER 45 (S^3-A) OBSERVATIONS OF THE MAGNETOSPHERE AND MAGNETOPAUSE DURING THE AUGUST 4–6, 1972, MAGNETIC STORM PERIOD. Hoffman, R.A. (Laboratory for Planetary Atmospheres, Goddard Space Flight Center, Greenbelt, Maryland 20771); Cahill, L.J. Jr.; Anderson, R.R.; Maynard, N.C.; Smith, P.H.; Fritz, T.A.; Williams, D.J.; Konradi, A.; Gurnett, D.A. J. Geophys. Res. 80: No. 31, 4287-4296 (1 Nov 1975).

The Explorer 45 (S^3-A) satellite performed extensive field and particle measurements in the heart of the magnetosphere during the double magnetic storm period of August 4–6, 1972. Both the ground level magnetic records and the magnetic field deformations measured along the orbit by the satellite indicated the existence of only a moderate ring current. This was confirmed by the measurements of the total proton energy density by the on-board particle detectors, which showed a maximum energy density less than the densities observed during the December 1971 and June 1972 magnetic storms. The plasmapause in the noon quadrant was eroded continuously from the onset of the first storm at the beginning of August 4 to an altitude below $L=2.07$ at about 1800 hours on August 5. Throughout the entire orbit during which the second sudden commencement occurred a large amount of low-frequency electric and magnetic field noise was encountered. The most remarkable observation during this orbit was the contraction of the magnetopause to distances inside the satellite location at $L=5.2$. The magnetic field reversed direction and increased in magnitude to more than 500 γ, the particle detectors encountered huge fluxes of streaming protons, and the field detectors measured intense broad band noise. Following the period of magnetospheric boundary crossings, Explorer 45 encountered a series of large-amplitude magnetospheric oscillations, seen both in the dc and low-frequency field measurements and in the intensities of the particle fluxes. As is true for other storms, a region of detached plasma or a taillike structure was encountered in the dusk hours during the development of the second main phase, and a nose structure in the proton ring current distribution was observed, which has been shown to be a characteristic feature in the dusk hours during the ring current development. (auth)

18328 A DETERMINATION OF F REGION EFFECTIVE RECOMBINATION COEFFICIENTS FROM THE ECHO 2 SOUNDING ROCKET PLASMA WAVE AND PARTICLE MEASUREMENTS. Arnoldy, R.L.; Hendrickson, R.A.; Winckler, J.R. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnestoa 55455). J. Geophys. Res. 80: No. 31, 4307-4312 (1 Nov 1975).

The effective dissociative recombination coefficient is calculated at 140- and 225-km altitude by using the Echo 2 rocket flight data. The density of ambient electrons in the immediate vicinity of the rocket payload was measured by the detection of plasma frequency emissions produced by the injection of 40-keV electrons from the accelerator carried aboard the rocket. Electrostatic analyzers measured the directional intensity of the weak auroral precipitation producing the ionization. Under the assumption of equilibrium conditions the value of α obtained at 140 km was between 1.3×10^{-7} and 1.7×10^{-7} cm^3 s^{-1}, depending on the pitch angle distribution of the precipitated auroral electrons used in the calculation of the ion production rate. The recombination coefficient obtained at 225 km varied from 1.2 to 6.2×10^{-9} cm^3 s^{-1}. The 140-km values compare favorably with laboratory data and are consistent with previous satellite and rocket measurements. The 225-km values are much less certain in that the data suggest that transport of ionization cannot be ignored at this altitude. Both the 140-km and the 225-km values could be low, due to lack of knowledge of the local spectrum below 0.9 keV. (auth)

18329 SUBSONIC MAGNETOSHEATH OBSERVATIONS FROM EXPLORER 33. Crooker, N.U.; Siscoe, G.L. (Center for Space Research, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). J. Geophys. Res. 80: No. 31, 4368-4371 (1 Nov 1975).

Data are presented from one orbit of Explorer 33 which entered the magnetosphere near the stagnation point. Magnetic activity as measured at the earth wave relatively quiet during the orbit, although minor substorm activity began 2 hours prior to the boundary crossing. Well before entry the magnetosheath observations show flow patterns consistent with hydrodynamic models. Near the stagnation point close to the boundary the observations show rapid variations between virtually isotropic flux (stagnated flow) and flow tangent to the boundary in alternately opposite directions. Movement of the stagnation point of the order of 1 $(R)_E$ is inferred from these observations. Multiple boundary crossings are observed in the magnetic field covering a thickness of about 500 km. Prior to the magnetic crossings the higher-energy proton fluxes begin to disappear. The bulk of the proton flux in the lower energy ranges and also the electron flux decrease rapidly at the last magnetic crossing. No boundary is apparent in the highest energy range measured by the detector. Further results await analysis of the 20 remaining orbits of Explorer 33 which traverse the magnetosheath in the subsonic region. (auth)

18330 ^{3}He/^{4}He RATIOS IN THE LOWER RADIATION BELT AS MEASURED BY TRAPPED PARTICLES IN A RECOVERED SATELLITE. Warasila, R.L.; Schaeffer, O.A. (Department of Earth and Space Sciences, State University of New York, Stony Brook, N.Y. 11794). Geophys. Res. Lett. 2: No. 11, 480-482 (Nov 1975).

Helium-3 has been found in the aluminum antenna housing from the recovered second stage of a pre-Apollo Saturn test flight launched January 28, 1964 and returned to earth on April 28, 1966. The amount of ^{3}He found is about 6×10^{-10} cc (STP)/cm^2 with a ^{4}He/^{3}He ratio of 145 or less. The ^{3}He is shown to come from the lower radiation belt as all other sources of ^{3}He are orders of magnitude lower than the observed value. We suggest that there is a significant component of low energy flare particles in the radiation belts, although it is impossible to rule out other origins. (auth)

18331 INTERPRETATION OF APPARENT PHASE MOTION IN MICROPULSATION SIGNALS. Southwood, D.J. (Imperial College, Physics Department, London SW7 2AZ). Geophys. Res. Lett. 2: No. 11, 483-484 (Nov 1975).

It is shown that phase differences in geomagnetic micropulsation signals seen at different locations should bear a direct relationship to energy flux in the magnetospheric wave structure. (auth)

18332 A WAVE MODEL OF NEAR WAKES. Liu, V.C. (Department of Aerospace Engineering, The University of Michigan, Ann Arbor, Michigan 48105). Geophys. Res. Lett. 2: No. 11, 485-488 (Nov 1975).

A new model for the near-wake studies is presented. It pertains to a tenuous plasma medium with negligible magnetic field effects. The wake-generating body moves at a mesothermal speed (V_b) i.e. intermediate between the thermal speeds of ions and electrons of the ambient plasma which is bi-thermal ($T_i<T_e$) and has a Debye length ($\lambda_D=(kT_e/4\pi e^2n_0)^{1/2}$ much smaller than the body size. The model is constructed by using the concept that the cavity left by a rapidly moving body acts as a generator of finite-amplitude ion acoustic waves which are excited by an initial discontinuity of plasma density at the leading edge of the cavity. This ionic wave motion, represented by fluid equations, is represented approximately by the time dependent (t), one-dimensional (x) Korteweg-de Vries equation. The solution to the KdV equation in (x,t) variables is shown to be closely related to the stationary solution of a two-dimensional wake in [x,z(= V_b t)] variables relative to a frame fixed to the body. Numerical and analytic solutions are both given. (auth)

18333 ON THE GENERATION OF MAGNETOHYDRODYNAMIC WAVES AT THE ONSET OF A SUBSTORM. Chang, R.P.H.; Lanzerotti, L.J. (Bell Laboratories, Murray Hill, New Jersey 07974). Geophys. Res. Lett. 2: No. 11, 489-491 (Nov 1975).

Theoretical analysis of magnetoacoustic waves driven unstable by a neutral charged-particle beam suggests that such waves can be generated in the plasma sheet at the onset of a substorm. It is further suggested that the magnetohydrodynamic waves observed to occur at the onset of substorms (often called Pi2 pulsations) may be attributed to the coupling of the magnetoacoustic waves to shear Alfvén waves on locally-resonant field lines on the nightside of the earth. Experimental determinations of the distribution of resonant field lines for various

frequency components of the waves, together with the theoretical concepts, can ultimately yield information on the inward velocity of hot plasma particles at substorm onsets. (auth)

18334 THE EARTH'S MAGNETOSPHERE. Akasofu, S. (Geophysical Institute of the University of Alaska in Fairbanks, Alaska); Lanzerotti, L.J. Phys. Today 28: No. 12, 28-35 (Dec 1975).

Far from being an empty cavity, as was once believed, the Earth's magnetic environment is filled with a diversity of plasma, wave and field conditions. (auth)

18335 NONLINEAR CURRENTS STIMULATED BY MONOCHROMATIC WHISTLER-MODE (WM) WAVES IN THE MAGNETOSPHERE. Crystal, T. L. Stanford, CA; Stanford Univ. (1975). 123p. University Microfilms Order No. 75-25,510.

Thesis (Ph. D.).

Artificially stimulated emissions (ASE) are a type of discrete magnetospheric emission triggered by manmade VLF signals. They are believed to result from cyclotron resonance interaction between a narrowband, whistler-mode (MW) signal and the energetic electrons which are trapped in the geomagnetic field. However the details of this emission mechanism are unknown as yet. A computer simulation is used first to find the nonfeedback response of a single electron to a quasimonochromatic WM wave in a one dimensional, homogeneous magnetoplasma. Next a WM wave is applied to a stream of such electrons, all having common v/sub perpendicular/ and v/sub parallel/. The stimulation of such currents is then simulated for a set of streams with near resonant v/sub parallel/ and with the same v/sub perpendicular/. Wave-stimulated stream currents can be plotted as v/sub parallel/ spectra at each alpha, showing for the first time the detailed behavior of the interaction bandwidth. These spectra indicate that untrapped electrons contribute significantly to the total stimulated current. The spectra are so narrowband that reasonable electron density gradients in velocity are found to have a negligible effect on the qualitative behavior of the corresponding total stimulated current; this result differs from the results of analytic treatments which rely on the anisotropy of the electron distribution to obtain any stimulated current. Reasons for these differences with analytic treatments are discussed. The pitch angle spectra show that electrons near the loss cone contribute little to the total current and therefore play only a minor role in any triggered emission mechanism. We conclude that VLF emission generation and electron precipitation involve two different electron populations. (Diss. Abstr. Int., B)

18336 SYNCHROTRON RADIATION FROM ELECTRONS IN THE EARTH'S MAGNETOSPHERE. Peng, S. Y. Albany; State Univ. of New York (1975). 132p. University Microfilms Order No. 75-25,780.

Thesis (Ph. D.).

Synchrotron radiation from electrons in the earth's magnetosphere was studied using a helical motion model. Electron energy and its pitch angle considered, ranged from 100 eV to 7 MeV and 0^0 to 180^0, respectively. Observation frequency of interest ranged from 0.1 to 50 MHz. General characteristics of synchrotron radiation as a function of electron pitch angle, energy, observation angle, harmonic number, observation frequency, and location of a radiating electron were numerically analyzed and discussed. The total synchrotron radiation from electrons in the inner and outer Van Allen belts and auroral zone was studied, using both conventional and complex electron distribution functions. For electrons located in the Van Allen belts, the calculated total synchrotron radiation was found to be dependent on electron pitch angle distribution as well as its energy distribution. The calculated synchrotron radiation from both low and high energy auroral electrons at a ground-based observing location has been compared with the observed radio noise at College, Alaska. Observed bursts like radio noise between frequencies 1 MHz and 7 MHz are indeed the synchrotron radiation from high energy precipitating auroral electrons. The observed spikes (narrow pulse) below 5 MHz are believed from low energy precipitating and backscattered electrons that are originated at heights below 2 R/sub E/. The best satellite location to detect synchrotron radiation is concluded to be above earth's north pole at a height of 1 R/sub E/ for the frequencies from 0.1 MHz to 30 MHz. (Diss. Abstr. Int., B)

18337 ALLOWANCE FOR RECONNECTION IN A MODEL OF THE MAGNETOSPHERE WITH AN INCLINED DIPOLE. Antonova, A. E.; Shabanskii, V. P. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 896-898(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1065-1068(1974).

A two-dipole model is used to analyze some structural characteristics of the magnetic field in the outer regions of the earth's magnetosphere that appear when allowance is made for the interplanetary magnetic field and for the seasonal and daily variations in the inclination of the geomagnetic dipole toward the earth–sun line. It is demonstrated that the use of these two factors in analysis leads to an asymmetry of the magnetosphere. (auth)

18338 DISTRIBUTION OF THE ELECTRIC FIELD IN THE OUTER MAGNETOSPHERE. Samokhin, M. V. (Radio Engineering Inst., Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 905-910(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1076-1083(1974).

The distribution pattern of the electric field in the equatorial plane of the magnetosphere is computed in the framework of a two-dimensional model. The plasmapause is approximated by a circle. The distortion of the shape of the plasmapause and the convection pattern in the presence of the diurnal harmonic of distortion of the symmetric distribution of the magnetospheric plasma are also analyzed. (auth)

18339 EFFECT OF AN EXTERNAL ELECTRIC FIELD ON DP1 AND DP2 CURRENT SYSTEMS. Tashkinova, L. G.; Tverskoy, B. A. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 911-914(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1084-1088(1974).

A boundary problem with an inhomogeneous boundary condition is formulated for the effect of an external electric field, which disturbs the equilibrium of the inner magnetosphere, with allowance for inhomogeneous ionospheric conductivity. It is shown that oscillations of the DP1 and DP2 current systems, which are the first and zeroth harmonics of the system of eigenfunctions of the problem, respectively, are sustained in the system. The oscillations of the DP2 current system lag in phase behind the inducing force by an angle $\varphi = \pi/5$, and those of the DP1 current system by an angle $\varphi = \pi/2$. (auth)

18340 EFFECT OF A HOT-PLASMA INHOMOGENEITY ON THE PROPAGATION OF HYDROMAGNETIC WAVES. Gokhberg, M. B.; Fedorov, E. E. (Inst. of Terrestrial Physics, Moscow). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 915-920 (1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1089-1094(1974).

A small inhomogeneous addition of the hot component of a plasma results in the drift of the electromagnetic field from a source of finite dimensions across the external field and perpendicular to the gradient of the inhomogeneity. (auth)

18341 GEOMAGNETIC FIELD AND TRAPPED PARTICLES IN THE NOON SECTOR OF THE MAGNETOSPHERE. Antonova, A. E.; Shabanskii, V. P. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 944-946(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1120-1122(1974).

A model of the magnetosphere which takes the isotropic component of the solar-wind pressure into account is discussed. (BJG)

18342 MOTION OF LOW-ENERGY ELECTRONICS IN A DIPOLE TRAP. Il'ina, A. N.; Il'in, V. D.; Gavrilov, V. I.; Pastukhov, A. P. (Moscow State Univ.). Geomagn. Aeron. (USSR) (Engl. Transl.); 14: No. 6, 946-948(1974).

Translated from Geomagn. Aeron.; 14: No. 6, 1123-1124(1974).

The residence time of electrons in the field of a uniformly magnetized sphere is investigated as a function of their energy. (auth)

18343 WHAT WE HAVE LEARNED FROM THE MAGNETOSPHERE. Kennel, C. F. (Univ. of California, Los Angeles). Comments Astrophys. Space Phys.; 6: No. 3, 71-80(1975).

Three topics are discussed: the central role of magnetic field line reconnection in determining the topology, geology, and dynamics of the magnetosphere, the realization that auroral arcs result from the coupling of solar wind stresses to the ionosphere and neutral atmosphere, and the role of plasma turbulence in affecting not only the microscopic state of the magnetospheric plasma, but also its macroscopic observables. (auth)

PHYSICS (ATOMIC AND MOLECULAR)

Refer also to abstract 18534.

18344 (NP-20771) ANNUAL REPORT, 1974. Blanc, D. (Toulouse-3 Univ., 31 (France). Centre de Physique Atomique). 1974. 127p. (In French). Dep. NTIS (US Sales Only) $6.00.

This report of activities for 1974 is divided into the following sections: instructional activities, scientific meetings and colloquia, activities of the atomic physics section (atomic collisions, post-luminescence of gases, direct current discharges in gases at intermediate and high pressures, electric arcs, physics of dielectrics, radiation transport in matter), section for the study of the physics of aerosols and atmospheric interchanges, and lists of personnel and theses. The report is descriptive in nature. (RWR)

Beams and Their Reactions

Refer also to abstracts 16849, 18404, and 18405.

18345 (LAL-RI-75-4) STUDY OF THE PRODUCTION AND CONFINEMENT OF POSITRON BEAMS. An Application to the Linear Accelerator of Orsay. Chehab, R. (Ecole Normale Superieure, 91 – Orsay (France). Lab. de l'Accelerateur Lineaire; Paris -11 Univ., 91 – Orsay (France)). Apr 1975. 138p. (In French). INIS.

This study on the production and confinement of positron beams is divided into three parts. In the first one, an analytical approximation of lateral, angular and energy distribution is given. This survey is based on the late tables of Messel and Crawford (1970) and is in good agreement with SLAC and FRASCATI estimations and measurements. Positron beam focusing is investigated in the second part; "quarter wave" and adiabatically tapered solenoids as well as pediodic multiplets are considered. More specially, positron injector focussing for DCI collision rings is described. In the last part of this work, a comparison between "quarter wave" and adiabatically tapered solenoids is presented. Larger total acceptance of the latter is pointed out in the range of medium and higher energy (≥ 1 GeV) accelerators. (FR)

18346 (ORNL-5046, pp 114-119) PHYSICS OF LIQUIDS AND SURFACES. Birkhoff, R. D.; Emerson, L. C.; Ashley, J. C.; MacRae, R. A.; Heller, J. M.; Painter, L. R. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Topics covered include: photon scattering from surfaces; collective electronic oscillations in liquids; thickness of contamination on the ORMAK liner; and electron energy losses in liquids. 8 figures. (GHT)

18347 ELECTRON PENETRATION AND POWER DISSIPATION IN THIN FILMS OF Gd_2O_3:Eu. Prener, J. S. (General Electric Co., Schenectady, NY). J. Electrochem. Soc.; 122: No. 11, 1516-1522(Nov 1975).

The cathodoluminescent brightness as a function of electron energy was measured for thin films of Gd_2O_3:Eu. Proper account is taken of the power dissipation of the electron beam in the thin Al layers deposited on top of the phosphor films. These Al films were necessary to prevent charging during the measurements. From an analysis of the data the power dissipation of the electron beam in the Gd_2O_3:Eu was derived. It was found that the results on power dissipation are in reasonably good agreement with theoretical calculations appearing in the literature. (auth)

18348 IMPACT-PARAMETER DEPENDENCE OF INELASTIC ENERGY LOSSES FOR He AND N IONS CHANNELED IN Si. Bulgakov, Yu. V.; Nikolaev, V. S.; Shulga, V. I. (Moscow State Univ.). Phys. Status Solidi (a); 31: No. 1, 341-350(Sep 1975).

Using the channeling technique, the impact-parameter dependence of inelastic energy loss of fast He and N ions with Si atoms has been measured. For He ions the dependences obtained are in a good agreement with Dettmann and Robinson's theory and are shown to allow the explanation of the shape of channeled ion energy distributions. (auth)

18349 CHANNELING OF HIGH ENERGY PROTONS IN Si AND W. Acerbi, E.; Birattari, C.; Candoni, B.; Castiglioni, M.; Succi, C. (Univ., Milan). Nuovo Cim.; 29B: No. 2, 257-269(11 Oct 1975).

The effect of channeling on the Rutherford scattering and the energy distribution of protons with initial energy between 20 and 39 MeV is shown for protons passing through single crystals of Si and W. The dechanneling effect as a function of depth in Si was studied by means of Rutherford scattering along the ⟨111⟩-axis and an exponential law was found. The energy spectrum of the transmitted protons showed that a distinct group of particles came through, with energy loss less than one half the normal energy loss for W and about 0.6 for Si. Stopping powers for channelled and random particles were calculated using the Bethe-Bloch formula and Bohr's suggestion of close and distant encounters. The agreement of calculated with measured values is discussed. (auth)

18350 SURFACE AND VACUUM PHYSICS INDEX. Volume 10, No. 9, 1975. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 50p.

18351 SURFACE AND VACUUM PHYSICS INDEX. Volume 10, No. 10, 1975. Bibliography, Author Index, Subject Index in Alphabetical Order, Cumulative Subject Index in Logical Order. Leopoldshafen, Ger.; Zentralstelle fuer Atomkernenergie-Dokumentation (1975). 63p.

18352 SPREAD OF ENERGY LOSSES BY FAST HELIUM AND NITROGEN IONS TRAVERSING METALLIC FILMS. Bednyakov, A. A.; Bulgakov, Yu. V.; Nikolaev, V. S.; Sobakin, V. P.; Popov, B. M. (Moscow State Univ.). Zh. Eksp. Teor. Fiz.; 68: No. 6, 2067-2074(Jun 1975). (In Russian)

The spread of the energy losses of helium and nitrogen ions with an initial energy $E_0 \sim 330$ keV/nucleon traversing aluminium, copper, silver and gold films of various thickness are measured. The maximal target thicknesses correspond to losses comprising about 80% of E_0. The dependences of the energy distribution widths η, for ions passing through the target, on the relative energy loss $\Delta E/E_0$ possess a flat maximum near $\Delta E/E_0 \sim 0.4 - 0.7$. Calculations carried out on basis of existing theories yield only qualitative agreement with the results of the measurements. Thus the calculated maximal values of η are from 1.5 to 2 times smaller than the measured values and correspond to somewhat larger values of $\Delta E/E_0$ ($\sim 0.6 - 0.8$). (auth)

18353 ALIGNMENT AND ORIENTATION EFFECTS IN BEAM-FOIL EXPERIMENTS. Band, Y.B. (James Franck Institute, University of Chicago, Chicago, Illinois 60637). Phys. Rev. Lett. 35: No. 19, 1272-1275 (10 Nov 1975).

I present a theory of the orientation and alignment of atoms observed upon emergence from tilted foils. The interaction with the foil surface is taken into account in the production process of particular states. Once they are produced, the evolution of these states, under the influence of the residual field near the surface, is calculated in the fashion introduced by Eck. The most general effect of this evolution is presented. (auth)

18354 THEORY OF FINAL-STATE COHERENCE IN BEAM—TILTED-FOIL INTERACTIONS. Herman, R.M. (Department of Physics, The Pennsylvania State University, University Park, Pennsylvania 16802). Phys. Rev. Lett. 35: No. 24, 1626-1629 (15 Dec 1975).

I propose a theory for the orientation and alignment of atomic states following atomic-beam passage through foils tilted through angle α from normal incidence. The final encounters within the foil operate on the existing foil-induced alignment, producing orientation and altered alignment. Within theoretical limitation, tensorial components transforming as angular momentum components in the collision frame vary as $\tan\alpha$, while those associated with the squares of components contain a $\tan^2\alpha$ dependence, in substantial agreement with observation. (auth)

18355 SOLID STATE STRUCTURE EFFECTS IN FLUORINE X-RAY SPECTRA PRODUCED BY HEAVY ION BOMBARDMENT. Moore, C. F.; Matthews, D. L.; Wolter, H. H. (Texas Univ., Austin (USA). Dept. of Physics). Phys. Lett., A; 54: No. 5, 407-408(6 Oct 1975).

Fluorine X-ray spectra produced by proton, alpha particle and oxygen ion bombardment of targets of LiF, NaF, CaF_2 have been measured. The K alpha satellite yields of fluorine are different in each fluorine crystal due to the electronic structure of the compounds, however, the K alpha hypersatellite yields are nearly identical. (NL)

18356 BEAM FOIL ELECTRON SPECTROSCOPY NEAR THE FORWARD DIRECTION. Menendez, M. G.; Duncan, M. M. (Georgia Univ., Athens (USA). Dept. of Physics). Phys. Lett., A; 54: No. 5, 409-411(6 Oct 1975).

Measurements are reported of angular distributions of the integrated yields and energy distributions of electrons having

velocities near the ion velocity for 0.75, 1 and 2 MeV ^{3}He II incident on amorphous carbon foils of 10, 20 and 50 $\mu g/cm^2$. (NL)

18357 STUDY OF LITHIUM WITH THE BEAM-FOIL SPECTROSCOPY METHOD IN THE RANGE OF WAVELENGTHS FROM 400 TO 1,900 ANGSTROEM. Schuermann, D. Bochum; Bochum Univ. (1973). 99p. (In German). INIS.

Thesis.

Electrostatically accelerated $^6Li^+$ ion in the energy region between 200 and 390 keV are focussed on a carbon foil having a weight per unit area of 5 $\mu g/cm^2$. The light emitted behind the foil from the electronically excited Li ions is analyzed with a Seya-Namioka vacuum UV monochromator in the region of 400 to 1,900 A and detected with channeltron type detectors. All Li II lines expected from the theory were detected – in one case up to n = 9 (n^3P levels), amongst these 13 for the first time. Furthermore, the Li III lines corresponding to the Balmer lines H_α, H_β, H_γ, H_δ and to the Paschen lines P_β, P_γ, P_δ with hydrogen are observed for the first time. (DE)

Atomic and Molecular Properties

Refer also to abstracts 18347, 18357, 18385, 18387, 18410, 18544, 18944, and 19131.

18358 MULTICONFIGURATION STUDIES OF SOME LOW-LYING BOUND STATES OF VH. Henderson, G. A.; Das, G.; Wahl, A. C. (Argonne National Lab., IL). J. Chem. Phys.; 63: No. 7, 2805-2809(1 Oct 1975).

Multiconfiguration calculations using a hybrid of multiconfiguration self-consistent field (MCSCF) and configuration interaction (CI) methods in a basis of Slater-type atomic orbitals (STO's) of nominal accuracy are carried out for some low-lying bound states of VH. All the lowest states of the symmetries, $^3\Sigma^-$, $^5\Sigma^-$, $^3\Pi$, $^5\Pi$, $^3\Delta$, $^5\Delta$, $^3\Phi$, and $^5\Phi$, that dissociate to the ground states of the constituent atoms are bound and so are some of the excited states that have higher-energy atomic dissociation products. The ground state is the lowest $^5\Delta$ state for which the spectroscopic constants are computed to be R_e = 3.33 bohr, D_e = 1.87 eV, and ω_e = 1585 cm^{-1}. Potential curves and the computed spectroscopic constants are presented for the lowest states of all the above symmetries. (auth)

18359 USE OF INTERFERENCE OF ATOMIC STATES FOR DETERMINING NUCLEAR CONSTANTS. Kaliteevskii, N. I.; Chaika, M. P. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1462-1465(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1646-1649(Aug 1970).

The phenomena, usually called level-crossing effects, found in the emission of an atom in the vicinity of a degenerate state are considered. Crossing levels are shown for cesium and sodium, and the intensities, widths, and hyperfine-structure constants discussed. The new method gives much more accurate values for the hyperfine structure constants and relative values for the magnetic and quadrupole moments, and may be used to estimate the nuclear octupole moment. (JFP)

18360 SPECTRUM OF THE K-LL AUGER ELECTRONS FROM POLONIUM (Z = 84). Babenkov, M. I.; Bobykin, B. V.; Petukhov, V. K. (Inst. of Nuclear Physics, Alma-Ata, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1498-1500(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1686-1688 (Aug 1970).

The K-LL Auger spectrum was examined with a double-focusing magnetic β spectrometer. The spectrum as recorded (without correction for decay during the measurement) is shown. The K-L_1L_3 line is somewhat broadened by the low energy tail of the K-L_2L_3 line. (JFP)

18361 COMPARISON OF X-RAY MnK$\alpha_{1,2}$ LINES OBTAINED DURING K-CAPTURE IN ^{55}Fe AND WITH PHOTON. Zhmudskii, A. Z.; Surzhko, V. F.; Shiyanovskii, V. I. (Kiev State Univ.). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 8, 1369-1372(Aug 1975). (In Russian).

It is found experimentally that interdoublet distance of the MnK$\alpha_{1,2}$-lines during K-capture in ^{55}Fe is 0.2 ± 0.1 eV greater than in photon excitation of Mn. Chiefly the K$\alpha_{1,2}$ line is shifted towards a short-wave side. A conclusion is made that the initial and finite states of x-ray transition K → L_{III} in the considered methods of excitation are not identical. (auth)

18362 INFLUENCE OF COLLISION PROCESSES ON SATURATED ABSORPTION LINE SHAPES. Kuehlke, D.; Doepel, E. (Univ., Jena, Ger.). Czech. J. Phys.; 25: No. 10, 1084-1094(1975).

The effect of collision processes especially of velocity-changing collisions on the shape and contrast of the absorption dips is examined considering the dynamical Stark effect. The velocity-changing collisions cause a homogeneous saturation of the Doppler-broadened absorption profile and a decrease of the contrast of the absorption dip, which is comparable with the decrease of the contrast due to the dynamical Stark effect for saturation intensities of the order $\sigma I \simeq 1$. The influence of the dynamical Stark effect decreases with increasing pressure whereas the influence of the homogeneous saturation increases. (auth)

18363 INVESTIGATION OF THE ENERGY TERMS OF A SYSTEM OF TWO METASTABLE HELIUM ATOMS. Kereselidze, T. M. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 1, 67-71(Jul 1975). (In Russian)

The behavior of $^1\Sigma_g^+$ terms of a system of two metastable helium atoms is investigated for small internuclear distances R. It is demonstrated that the system does not form a stable molecule since the total energy curve intersects a whole band of terms in the vicinity of the minimum; consequently, besides the previously known autoionization channel, at small distances a new channel of inelastic collisions of the second kind becomes open. (auth)

18364 MATRIX ELEMENTS OF THE COULOMB GREEN'S FUNCTION. Suffczynski, M.; Swierkowski, L. (Inst. of Physics, Warsaw). Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys.; 23: No. 7, 807-810(1975).

Integrals involving Coulomb Green's function for definite angular momentum are expressed by series of hypergeometric functions. (auth)

18365 THEORETICAL ANALYSIS OF THE HYPERFINE INTERACTION IN MSNL CONFIGURATIONS OF NEUTRAL Yb AND SINGLY IONIZED Lu. Holmgren, L. (Chalmers Tekniska Hoegskola, Goeteborg (Sweden)). Phys. Scr.; 12: No. 3, 119-124(Sep 1975).

Configuration with two open shells of the type msnl from the spectra of Yb I and Lu II are analyzed with respect to the hyperfine interaction. Radial integrals are evaluated from relativistic self-consistent-field wavefunctions. Formulas are presented for the magnetic dipole and electric quadrupole interaction constants using the effective-operator formalism on LS coupled wavefunctions. The spin polarization contributions to the magnetic dipole interaction constants in a general msnl configuration are also presented. From such configurations of Yb I and Lu II, mean values of the electric quadrupole moments have been evaluated, giving Q(^{173}Yb) = 3.6 b and Q(^{175}Lu) = 5.3 b (uncorrected for the Sternheimer effect). (NL)

18366 EFFECT OF A CONSTANT ELECTRIC FIELD ON THE RADIATION INTENSITY OF SPECTRAL LINES OF HELIUM. Yancharina, A.M.; Muravev, I.I. Opt. Spectrosc. (USSR) 39: No. 2, 127-129 (Aug 1975).

The behavior of the spectral intensities of helium lines, including forbidden lines, was studied in a constant electric field. The absolute values of the probabilities of forbidden transitions and their dependence on the field voltage were determined from measurements of the relative strengths of forbidden and allowed spectral lines with a common upper level. It was found that the appearance of forbidden transitions in the electric field leads to the depopulation of the excited states and to a decrease in their lifetime. (auth)

18367 EMISSION LINES OF THE *M*-SERIES OF RARE-EARTH METALS. Brytov, I.A.; Mstibovskaya, L.E. Opt. Spectrosc. (USSR) 39: No. 2, 229-230 (Aug 1975).

Using a vacuum spectrometer with flat crystals and laminar collimators, we have studied the emission spectra of Gd, Dy, Er, Tu, Yb and Lu.(AIP)

18368 HYDROGEN 1*S*-2*S* ISOTOPE SHIFT AND 1*S* LAMB SHIFT BY LASER SPECTROSCOPY. Lee, S.A.; Wallenstein, R.; Hänsch, T.W. (Department of Physics, Stanford University, Stanford, California 94305). Phys. Rev. Lett. 35: No. 19, 1262-1266 (10 Nov 1975).

We measured the isotope shift of the 1*S*-2*S* transition in atomic hydrogen and deuterium to be 670.933±0.056 GHz, using Doppler-free two-photon spectroscopy with a frequency-doubled, pulsed, dye laser. The Balmer-β line is simultaneously observed in saturated absorption with the fundamental dye-laser output. A comparison of the intervals 1*S*-2*S* and $2P_{3/2}$–$4D_{5/2}$ determines the Lamb shift of the 1*S* ground state to be 8.20±0.10 GHz (H) and 8.25±0.11 GHz (D), in agreement with the theoretical values. (auth)

18369 BINDING ENERGIES IN ATOMIC NEGATIVE IONS. Hotop, H. (Fakultät für Physik, Universität Freiburg, Freiburg, Germany); Lineberger, W.C. J. Phys. Chem. Ref. Data 4: No. 3, 539-576 (16 Oct 1975).

A survey of the electron affinity determinations for the elements up to Z_e=85 is presented, and based upon these data, a set of recommended electron affinities is established. Recent calculations of atomic electron affinities and the major semiempirical methods are discussed and compared with experiment. The experimental methods which yield quantitative electron binding energy data are described and intercompared. Based primarily upon extrapolation techniques, fine structure splittings for these ions and excited state term energies are given. (auth)

18370 WAVELENGTHS AND CLASSIFICATIONS OF EMISSION LINES DUE TO 2s^{2}2p/sup n/-2s2p/sup n+1/ AND 2s2p/sup n/-2p/sup n+1/ TRANSITIONS, Z less than or equal to 28. Fawcett, B. C. (Culham Lab., Abingdon, Eng.). At. Data Nucl. Data Tables; 16: No. 2, 135-164(Aug 1975).

Tables of wavelengths and classifications of observed emission lines due to 2s^{2}2p/sup n/-2s2p/sup n+1/ and 2s2p/sup n/-2p/sup n+1/ transitions are presented. The accuracy of data derived from different experimental methods is discussed. Revised and predicted wavelengths are added. Energy levels are derived from the wavelength data. (auth)

18371 COEFFICIENTS FOR EXPRESSING THE NONRELATIVISTIC ENERGY OF THE CONFIGURATION d/sup N/d WITH NONORTHOGONAL RADIAL ORBITALS. Sabas, K. V.; Vizbaraite, J. J.; Jucys, A. P. (Inst. of Physics and Mathematics, Vilnyus, USSR). At. Data Nucl. Data Tables; 16: No. 2, 179-200 (Aug 1975).

The coefficients in the expression for the nonrelativistic energy of atomic systems having configuration 3d/sup N/nd outside closed shells, in terms of radial integrals with nonorthogonal radial orbitals 3d and nd, have been calculated and tabulated. (auth)

Positronium, Muonium, and Muonic and Mesic Atoms and Molecules

Refer also to abstracts 17761, 18430, 19093, and 19101.

18372 PARITY NONCONSERVATION IN RADIATIONLESS TRANSITIONS IN μ-MESIC ATOMS. Gorshkov, V. G.; Mikhailov, A. I.; Moskalev, A. N. (Leningrad Inst. of Nuclear Physics). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1507-1516(Nov 1975). (In Russian).

Radiationless transitions in μ-mesic atoms involving the expulsion of shell electrons (Auger transitions) and the formation of electron-positron pairs are considered. It is shown that the weak interaction of neutral currents results in an asymmetry of electron and positron emission with respect to the initial muon polarization. The asymmetry coefficient in Auger transitions is 10^{-5} to 10^{-6}. The asymmetry coefficient during pair production can be increased by carrying out the measurements in the region of small total pair momenta. (auth)

18373 EXISTENCE OF MUONIUM IN METALS. Gorelkin, V. N.; Smilga, V. P. (Moscow Physical-Technical Inst.). Zh. Eksp. Teor. Fiz.; 69: No. 3, 949-954(Sep 1975). (In Russian)

The Wangsness–Bloch equations for muonium are solved in the absence of a magnetic field by taking into account two-time μ^+-meson spin relaxation. It is demonstrated that an analysis of the mean μ^+-meson polarization in superconductors should decide whether muonium atoms are formed in metals. It is noted that in a sufficiently large number of cases allowance for two-time relaxation is necessary in analyzing mean polarization. (auth)

18374 DOES A HEAVY POSITRONIUM ATOM EXIST? Moffat, J.W. (Department of Physics, University of Toronto, Toronto, Ontario, M5S 1A7 Canada). Phys. Rev. Lett. 35: No. 24, 1605-1606 (15 Dec 1975).

Recently reported observations in e^+e^- collisions suggest the existence of a heavy lepton L^* with a mass $\sqrt{s}\sim 2$ GeV. I predict that a heavy prositronium atom exists, which is an L^+L^- bound state. Its detection would confirm the existence of a heavy lepton. A way is suggested to detect this heavy atom by looking for an x-ray signal of a specific energy in e^+e^- collisions. (auth)

18375 NEW MUONIC-ATOM TEST OF VACUUM POLARIZATION. Dixit, M.S.; Carter, A.L.; Hincks, E.P.; Kessler, D.; Wadden, J.S. (Carleton University, Ottawa, Canada, K1S 5B6); Hargrove, C.K.; McKee, R.J.; Mes, H.; Anderson, H.L. Phys. Rev. Lett. 35: No. 24, 1633-1635 (15 Dec 1975).

In order to check the discrepancy between calculation and experiment in muonic atoms, we have remeasured the 5g-4f transitions in Pb and the 5g-4f and the 4f-3d transitions in Ba. Our new results show no discrepancy and confirm recent theoretical calculations of vacuum polarization to within 0.5%. (auth)

18376 POSITRONIUM: PRECISION DETERMINATION OF THE GROUND-STATE FINE-STRUCTURE INTERVAL $\Delta\nu$, AND MEASUREMENT OF DENSITY SHIFTS IN THE NOBLE GASES. Egan, P. O.; Frieze, W. E.; Hughes, V. W.; Yam, M. H. (Yale Univ., New Haven, Conn. (USA). Gibbs Lab.). Phys. Lett., A; 54: No. 5, 412-414(6 Oct 1975).

The positronium n = 1 fine-structure interval, $\Delta\nu$, has been measured in nitrogen yielding $\Delta\nu$ = 203.3849(12)GHz. Comparison with theory shows the need to calculate higher-order theoretical terms. The positronium density shifts in the noble gases were also measured. (NL)

18377 NUCLEAR MATRIX ELEMENTS OF NEUTRAL CURRENTS IN MUONIC ATOM DECAYS. Lin, D. L.; Chen, M. Y. (Columbia Univ., New York (USA). Dept. of Physics). Nucl. Phys., A; 251: No. 3, 457-464(27 Oct 1975).

The nuclear matrix elements of the parity-violating effects of neutral currents are examined for the three light nuclei ^{6}Li, ^{7}Li, and ^{9}Be. These matrix elements will play important roles in the quantitative analysis of neutral currents if the hyperfine effects in parity-violating muonic atom decays are actually observed. The matrix elements are related to magnetic electron scattering data. For ^{6}Li, for which scattering data are available, the calculated matrix elements contain the least uncertainty from nuclear physics. For ^{7}Li and ^{9}Be, for which data are unavailable, reasonably good models, such as the j-j coupling limit and the intermediate coupling model, are employed in computing the matrix elements. (NL)

18378 ELECTRIC FIELD DEPENDENCE OF POSITRONIUM FORMATION IN CONDENSED MATTER. Brandt, W.; Wilkenfeld, J. (New York Univ., NY). Phys. Rev., B; 12: No. 7, 2579-2587(1 Oct 1975).

Electrostatic fields affect the lifetime spectra of positrons annihilating in normal paraffins and polyethylenes. The intensity of the longest lived of the three resolved lifetime components decreases by almost 50 percent at the highest fields (approximately 200 kV/cm). The dependences of the data on density, temperature, and electric field are interlinked in a comprehensive manner by a theory which depends parametrically on the cross sections for the interaction of epithermal positrons with the molecular ($-CH_2-$) repeat units. Inferences are drawn for electronic subionization processes in insulators. (auth)

Collision Phenomena

Refer also to abstracts 18349, 18351, and 18757.

18379 (AD/A-007972) INVESTIGATION OF ION–ION RECOMBINATION CROSS SECTIONS. Final Technical Report, 19 October 1971–18 October 1974. Bennett, R. A.; Huestis, D. L.; Moseley, J. T.; Mukherjee, D.; Olson, R. E. (Stanford Research Inst., Menlo Park, Calif. (USA). Molecular Physics Center). 27 Nov 1974. Contract F19628-72-C-0121. 132p. (SRI-MP-74-50). NTIS $5.75.

An experimental and theoretical investigation of ion–ion mutual neutralization was made. Two-body neutralization rates were measured for $NO^+ + O_2^-$, $N_2^+ + NO_2^-$, and $N^+ + O^-$ over the energy range from above 10 eV to 0.15 eV; and the results, extrapolated and thermally averaged to yield reaction rates at 300K. In addition, preliminary measurements were obtained on $O^+ + OH^-$ and $NO^+ + OH^- - H_2O$, and a few data were obtained on $N_2^+ + OH^- - H_2O$. An investigation of excited states in ion beams did not reveal the presence of any such states, but did allow measurements of electron loss cross sections for O^-, O_2^-, NO_2^-, and NO_3^- on a variety of atoms and molecules at energies from 1 to 4 keV. The theoretical program was directed toward understanding the processes by which clustered ions are neutralized. The most favorable process is orbital capture of one ion by the other due to Coulomb excitation of the internal degrees of freedom of the clusters. A variety of calculations were performed on the neutralization of NO^+ by O^-. (GRA)

18380 (CPAT-RA-74) PROGRESS REPORT OF 1974. Blanc, D. (Toulouse-3 Univ., 31 (France). Centre de Physique Atomique). 1974. 122p. (In French). INIS.

Research work carried out at the CPAT is presented. It covers the following fields: atomic collisions, afterglow in gases, d.c. electric discharges in gases at intermediate and high pressures, electric arcs, dielectrics, and radiation transport in matter. The

physics of aerosols and atmospheric exchanges is also studied. (FR)

18381 (FRNC-TH-535) PRODUCTION OF H(2s) FAST METASTABLE ATOMS (0.25-3 keV) ON A Cs TARGET. Detection of the α Lyman Radiation Induced by Stark Effect: Polarisation. Destruction of H(2s) Atoms on an IH Target. Valance, Antoine. (Paris-11 Univ., 91 – Orsay (France)). 1974. 166p. (In French). INIS.

The production, detection and destruction of the 2S1/2 metastable state of the hydrogen atom were studied. The quasi-resonant charge exchange processes between fast protons and cesium targets, in the total cross sections for production of metastable H(2s) atoms and radiative H(2p) atoms, showed structures hitherto unobserved. The theoretical study is based on calculation of the adiabatic molecular potential terms of the ionic quasi-molecule $(CsH)^+$, taking a Helmann type pseudopotential to describe the electron with respect to the core of the cesium ion. The probabilities of transition towards the output channels are calculated using a stationary state perturbation method. From the data obtained the interference phenomena of excited quasi-molecular states can be interpreted coherently in slow collision. The probability of transition along the inelastic output channels displays characteristics of a harmonic oscillatory function inversely proportional to the speed of approach of the particles. The frequency of these oscillations depends very slightly on the impact parameter. The theory proposed involves three Σ states. During detection of the metastable ions the Lyman-α radiation induced in the de-excitation electric field by Stark effect presents anisotropic features. The degree of polarization measured as a function of the field strength oscillates around a slow decay toward a limit-1 at strong electric field. A theory not accounting for the hyperfine structure of states mixed by Stark effect showed a double oscillatory structure containing the two frequencies correlated to the 2P1/2 and 2P3/2 states from the 2S1/2 state. Finally the results on the electron detachment reaction between fast metastable atoms and hydroiodic acid target have contributed towards research on polarized proton sources. (FR)

18382 (IPNO-T-75-04) STUDY OF CHARGE EXCHANGES OF HEAVY IONS PASSING THROUGH SOLIDS. Baron, E. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 – Orsay (France)). 1975. 95p. (In French). INIS.

The charge state distributions of 1 to 6 MeV/nucleon heavy ions (from oxygen to krypton) passing through thin targets of various materials (C, Cu, Ag, Au) are studied. The variation of the average charge state and of the charge state fractions as a function of the thickness of carbon targets ranging from zero to the equilibrium thickness is measured; this allows the calculation of effective cross-sections of the charge changing process. It is also shown that the lower the target atomic number, the higher the average charge state, which is explained by a decrease of the capture cross sections. Finally, a semi-empirical formula predicting the average charge state is proposed as an extension of Betz, Nikolaev, and Dmitriev's formula. (FR)

18383 (ORNL-5046, pp 103-113) ATOMIC AND MOLECULAR PHYSICS. Anderson, V. E.; Cox, J. T.; Huynh, Q. A. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Topics covered include: electron attachment to SO_2 in high pressure gases; long-lived parent negative ions formed via nuclear-excited Feshbach resonances, part IV, a systematic study of NO_2-containing benzene derivatives; threshold-electron excitation and compound-negative-ion states of aromatic hydrocarbons; linking of existing data on electron-molecule interactions in gases with those in the liquid phase; slowing down of subexcitation electrons in polyatomic gases; electron mobilities in high-pressure gases (''quasi-liquids''); measurement of the mobility of excess electrons in liquids; potential energy function of an excess electron in a nonpolar liquid; electron mobilities in gases and liquids; photophysics of aromatic hydrocarbons; synthesis of electron-molecule interactions with benzene and benzene derivatives; and spin-off of basic studies on electron attachment to, and elastic scattering from, polyatomic molecules. 14 figures, 2 tables. (GHT)

18384 (ORNL-5046, pp 157-173) CHEMICAL PHYSICS STUDIES. Compton, R. N.; Callcott, T. A.; Carter, A. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Topics covered include: negative ion formation in organic molecules; negative-ion formation in $Fe(CO)_5$ and $Ni(CO)_4$; collisional ionization of Na, K, and Cs by CO_2, COS, and CS_2, electron affinities; abnormally large electron affinities for some hexafluoride molecules; pi-electron affinities for organic molecules; gas phase laser-ion spectroscopy; studies of dissociative ionization by electron impact; ionization potentials of organic donor molecules; reactions of electronically excited atoms; kinetic energy production from unimolecular dissociations; optical and electrical measurements on organic semiconductors; level shifts from coulomb interaction of atoms in a gas; and rotational resonance in low-energy electron-H_2 scattering. 24 figures, 3 tables. (GHT)

18385 (ORNL-5046, pp 174-196) ATOMIC PHYSICS AND LASER RESEARCH. Hurst, G. S.; Payne, M. G.; Chen, C. H. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Topics covered include: resonance ionization spectroscopy; energy pathways and Jesse effects in helium; energy transfer; laser applications; and analytical applications. (GHT)

18386 MOLECULAR BEAM STUDIES WITH A TIME-OF-FLIGHT MACHINE. Beijerinck, H. C. W. Eindhoven, Netherlands; Technische Hogeschool (1975). 179p.

Thesis.

The study concerns the development of the time-of-flight method for the velocity analysis of molecular beams and its application to the measurement of the velocity dependence of the total cross-section of the noble gases. It reviews the elastic scattering theory, both in the framework of classical mechanics and in the quantum mechanical description. Attention is paid to the semiclassical correspondence of classical particle trajectories with the partial waves of the quantum mechanical solution. The total cross-section and the small angle differential cross-section are discussed with special emphasis on their relation. The results of this chapter are used later to derive the correction on the measured total cross-section due to the finite angular resolution of the apparatus. Reviewed also is the available information on the intermolecular potential of the Ar–Ar system. Then a discussion of the measurement of total cross-sections with the molecular beam method and the time-of-flight method is compared to other methods used. It is shown that the single burst time-of-flight method can be developed into a reliable and well-calibrated method for the analysis of the velocity distribution of molecular beams. A comparison of the single burst time-of-flight method with the cross-correlation time-of-flight method shows that the two methods are complementary and that the specific experimental circumstances determine which method is to be preferred. Molecular beam sources are discussed. The peaking factor formalism is introduced and helps to compare the performance of different types of sources. The effusive and the supersonic source are treated and recent experimental results are given. The multi-channel source is treated in more detail. For the opaque mode, an experimental investigation of the velocity distribution and the angular distribution of the flow pattern is presented. Comparison of these results with Monte Carlo calculations for free molecular flow in a cylindrical channel gives a good qualitative insight in the process of beam formation. (NL)

18387 ENERGY DISTRIBUTION OF SECONDARY ELECTRONS. II. Normalization and Extrapolation of Experimental Data. Kim, Y. K. (Argonne National Lab., IL). Radiat. Res.; 64: No. 2, 205-216(Nov 1975).

A simple but powerful method of constructing a consistent set of energy distributions for secondary electrons produced by electron impact is presented. The method uses graphical presentations known as the Platzman and the Fano plots. Recommended energy distributions for He and N_2 are given for a wide range of primary-electron energies (50 to 100 keV). Data necessary for extrapolating the distribution to higher incident energy are also included. (auth)

18388 MODEL STUDY OF COLLISION INDUCED DISSOCIATION OF A DIATOMIC MOLECULE BY AN ATOM. Ford, L. W. (Purdue Univ., Lafayette, IN); Diestler, D. J.; Wagner, A. F. J. Chem. Phys.; 63: No. 5, 2019-2034(1 Sep 1975).

The time-dependent Schroedinger equation for the collinear collision of an atom with a diatomic molecule is solved numerically after the manner of McCullough and Wyatt. The binding potential is taken to be a truncated square well and the interaction is impulsive (hard sphere). For the case in which all three masses are equal final relative momentum distributions and dissociation probabilities are obtained as a function of both the initial relative kinetic energy and the initial vibrational level. For purposes of comparison quasiclassical trajectory analyses of the same cases were performed. Quantum effects on collision-induced dissociation (CID) are seen to be important for this model. A very notable characteristic of the model, observed in both the quantum and classical results, yet not in most experimental results, is that CID is severely vibrationally inhibited, i.e., the probability of CID decreases as the initial vibrational quantum number increases at a fixed total collision energy. Probable causes of this strong vibrational inhibition are examined classically by a detailed trajectory analysis. It is concluded that the collinearity of the model is most likely responsible. (auth)

18389 POLARIZATION AND EFFECTIVE CROSS SECTION FOR THE EXCITATION OF THE RESONANCE RADIATION OF Sr^+ IONS BY ELECTRON COLLISION. Dashchenko, A. I.; Zapesochnyi, I. P.; Imre, A. I.; Kel'man, V. A. (Uzhgorod State Univ., USSR). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 7, 1214-1216(Jul 1975). (In Russian)

The excitation and polarization of the resonance transitions of Sr^+ during electron-ion collisions were studied by the crossed modulated beam method. The basic cascade contribution in the energy range from threshold up to 100 eV was measured. Close to the excitation threshold the degree of polarization of the strong component of the resonance doublet (407.8 nm) is $23 \pm 4\%$ and at 100 eV it is $-7 \pm 3\%$. The polarization of the weak component (424.6 nm) was not detected. With consideration of the data on the cross section for the excitation of the resonance lines, the polarization of the resonance radiation, the role of the cascade population, and the probability of radiation decay of the resonance states in the metastable 4^2D state, the effective cross sections for the excitation of the resonance levels of Sr^+ were determined. At threshold energy they are equal to $21.3 \pm 4 \times 10^{-16}$ cm^2 for the $5^2P_{\frac{1}{2}}$ state and $10.7 \pm 2.1 \times 10^{-16} cm^2$ for the $5^2P_{\frac{3}{2}}$ state. The measured cascade contribution is insignificant (less than 7% at 100 eV). (tr-auth)

18390 ASYMPTOTIC CHARGE EXCHANGE THEORY FOR ARBITRARY VELOCITIES. Demkov, Yu. N.; Ostrovskii, V. N. (Leningrad State Univ.). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1582-1593(Nov 1975). (In Russian).

An asymptotic (with respect to impact parameter) charge exchange theory is developed for arbitrary collision velocities. The dominant asymptotic amplitude term is calculated in the general nonresonant case for transitions between atomic s-states. The result is compared with data of various approximate methods. Concrete examples of resonance ($p + H \rightarrow H + p$) and nonresonance ($Li^+ + Na \rightarrow Li + Na^+$) charge exchange processes are considered. (auth)

18391 MEASUREMENT OF THE MOMENTUM DISTRIBUTIONS OF THE K-ELECTRONS OF LIGHT ATOMS. Krasil'nikova, N. A.; Levin, V. G.; Persiancheva, N. M. (Moscow State Univ.). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1562-1568(Nov 1975). (In Russian).

Results of experiments on electron ejection by fast electrons incident on thin self-supporting carbon or collodion films are presented for primary electron energies of 10 to 11 keV. Peaks in the energy spectrum of the process are observed which can be ascribed to ejection of K-electrons from carbon, nitrogen and oxygen and also of outer weakly bound electrons. Angular correlations of the emitted and scattered electrons recorded in coincidence are measured for the K-shells of carbon and oxygen. The experimental data are analyzed within the framework of the momentum approximation in which the behavior of the (e,2e) reaction cross section is determined by the momentum distribution of the target electrons with a given binding energy. The momentum distributions calculated by means of Hartree–Fock wave functions are in agreement, within the limits of the experimental errors, with the results of measurements of the angular correlations. (auth)

18392 SECOND BORN RESULTS OF SOME CHARGE EXCHANGE SCATTERINGS. Konar, A. N. (Jaipuria Coll., Calcutta). Czech. J. Phys.; 25: No. 10, 1095-1098(1975).

Second Born results for charge exchange scattering cross sections of proton in hydrogen and singly ionized helium atoms–alpha particles in hydrogen and singly ionized helium atoms were obtained for low to very high energies. The results show some interesting points of physical importance. (auth)

18393 INTERACTION BETWEEN ION AND ATOM IN THE QUASICLASSICAL APPROXIMATION. Chibisov, M. I. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 2, 457-466(Aug 1975). (In Russian).

A new method is proposed for setting up throughout the whole volume the correct zero approximation wave function in the two-center problem for large distances between the centers. The function is employed for calculating the exponential part of the asymptotic interaction between an atom and a foreign ion which does not possess core electrons (proton, α particle etc.). It is shown that the interaction is determined by an exponentially small probability of the electron remaining near the perturbing nucleus. The interaction is compared with polarization interaction in concrete cases, and it is found that even for such strongly polarized atoms as the alkaline earth metals both types of interaction are approximately the same at intermediate internuclear distances. The interactions calculated correspond to thermal and subthermal energy ranges. (auth)

18394 COLLISIONS INVOLVING ENERGY TRANSFER BETWEEN ATOMS WITH LARGE ANGULAR MOMENTA. Vdovin, Yu. A.; Galitskii, V. M. (Moscow Engineering-Physics Inst.). Zh. Eksp. Teor. Fiz.; 69: No. 1, 103-107(Jul 1975). (In Russian)

The excitation transfer cross section is calculated for collisions between excited and unexcited atoms possessing a small resonance defect. It is assumed that the excited and ground states of each of the atoms are coupled by an allowed dipole transition and the angular momenta of these states are large. It is demonstrated that for a small resonance defect the excitation transfer cross section exceeds the respective resonance cross section. (auth)

18395 INVESTIGATION OF RESONANCES IN THE TOTAL CROSS SECTIONS FOR EXCITATION OF MERCURY ATOMS BY SLOW MONOENERGETIC ELECTRONS. Shpenik, O. B.; Sovter, V. V.; Zavilopulo, A. N.; Zapesochny, I. P.; Kontrosh, E. E. (Uzhgorod State Univ., USSR). Zh. Eksp. Teor. Fiz.; 69: No. 1, 48-58(Jul 1975). (In Russian)

Precise measurements of mercury excitation processes induced by slow electrons are carried out with an arrangement which includes a trochoidal electron spectrometer. The energy dependences of the total excitation cross sections are measured for 12 lowest energy levels in the case of an electron energy spread of 0.04 to 0.14 eV. The analysis of the structure of the excitation functions under the application of the Breit–Wigner and Fano formulas revealed 15 resonances in the spectral line and level excitation functions in the region between 4.5 and 12.5 eV of the bombarding electron energies. Their energy positions are determined and resonance widths estimated. Possible states of the negative mercury ion due to the appearance of the resonances are discussed. (auth)

18396 VACANCY FORMATION IN THE K-SHELL IN COLLISIONS BETWEEN HEAVY ATOMS. Duman, E. L.; Smirnov, B. M. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 1, 59-66(Jul 1975). (In Russian)

The cross section for K-shell vacancy formation in collisions between heavy atoms is calculated within the framework of the Fano–Lichten model. Transitions from $2s\sigma$ or $2p\pi$ quasimolecular states, which for $R \rightarrow \infty$ correlate with the L-shells of one of the partners, to $1s\sigma$ or $2p\sigma$ states, which for infinite separation of the nuclei go over to the K-shell of the atom or ion, are considered. There are three mechanisms which lead to transitions between these states. Each of these mechanisms significantly contributes to the cross section for vacancy formation in the K-shell in various ranges of collision kinetic energy. It is shown that for collision energies between 10 to 100 keV the main contribution to the cross section is made by transitions related to rotation of the quasimolecule axis. For various mechanisms analytic expressions are obtained for the cross sections of transitions which lead to K-vacancy formation. The theoretical calculations are compared with the experimental data. (auth)

18397 ELASTIC SCATTERING OF SLOW ELECTRONS BY ATOMS. Amus'ya, M. Ya.; Cherepkov, N. A.; Chernysheva, L. V.; Shapiro, G. S.; Tanchich, A. (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksp. Teor. Fiz.; 68: No. 6, 2023-2031 (Jun 1975). (In Russian)

The total and differential cross section for scattering of 30-eV electrons by He, Ar and Xe atoms are calculated by taking into account multielectron correlations. (auth)

18398 MEASUREMENT OF THE RATE OF CHEMICAL RELAXATION OF THE VIBRATIONAL ENERGY OF DEUTERIUM MOLECULES IN THE REACTION $D + D_2(v = 1) \rightarrow D_2(v = 0) + D$. Gershenzon, Yu. M.; Rozensbtein, V. B. (Inst. of Chemical Physics, Moscow). Dokl. Phys. Chem. (Engl. Transl.); 221: No. 1-3, 284-287(Mar 1975).

Translated from Dokl. Akad. Nauk SSSR; 221: No. 3, 644-647 (Mar 1975).

The present work is devoted to measuring the rate constant for the relaxation of vibrationally excited deuterium molecules on deuterium atoms in a temperature range of 300-520°K. The $D_2(v = 1)$ was registered by means of exchange luminescence. The term exchange luminescence is intended to mean the IR emission following the exchange of vibrational energy between a nonemitting molecule and the emitting molecule. In [1] it was shown that the rate constant for the transfer of a vibrational quantum from deuterium to the asymmetric stretching vibration of $CO_2(k_e)$ is $\sim 10^4$ $sec^{-1} \cdot torr^{-1}$. We have discovered that strong IR emission occurs when deuterium which has been passed through a high-frequency discharge is mixed with carbon dioxide or nitrous oxide. An estimate based on a comparison of the exchange luminescence signals for the $D_2 - CO_2$ and $N_2 - CO_2$ systems shows that in a zone removed from the discharge zone by a time of 20 msec, almost all the vibrational energy of the deuterium molecules is concentrated

in the first vibrational level. Subsequently, therefore, we will assume that the luminescence intensity is proportional to the concentration of D_2 (v = 1) at the point where it is mixed with CO_2.

18399 ENERGY DEPENDENCE OF THE CROSS SECTION FOR ELASTIC SCATTERING OF SLOW ELECTRONS BY POSITIVE IONS THROUGH AN ANGLE OF 180°. Drukarev, G. F.; Berezina, N. B. (Leningrad State Univ.). Zh. Eksp. Teor. Fiz.; 69: No. 3, 829-832(Sep 1975). (In Russian)

Some features of scattering of slow electrons by positive ions through an angle of 180° are discussed. The energy dependence of the scattering cross section is calculated for K^+, Na^+, Mg^{+2}, Yb^{+2}, V^{+5} and Sc^{+3} ions. As a rule the cross sections at low energies are found to exceed considerably the Rutherford cross section. A minimum in the low energy region is observed for the Na^+ ion. (auth)

18400 MULTIPLE SCATTERING OF keV IONS: LATERAL DISTRIBUTION IN XENON. Sidenius, G. (Niels Bohr Institutet, Copenhagen (Denmark)); Andersen, N. (Copenhagen Univ. (Denmark). H. C. Oersted Inst.). Nucl. Instrum. Methods; 128: No. 2, 271-276(1 Oct 1975).

The present paper reports measurements of lateral distributions of multiply scattered ions with $1 \leq Z \leq 19$ and incident energies in the 20-180 keV range on a xenon gas target of reduced thickness τ from 0.07 to 0.40. The results are in excellent agreement with recent theoretical predictions by Marwick and Sigmund with respect to the magnitude of the half-widths, the detailed shape of the distributions, and the scaling law relating the angular and the lateral multiple scattering distributions. (NL)

18401 CLASSICAL TRAJECTORY STUDY OF ROTATIONAL RELAXATION OF MOLECULAR HYDROGEN: DEPENDENCE ON THE POTENTIAL SURFACE. Alper, J. S. (Department of Chemistry, University of Massachusetts, Boston, Massachusetts 02125, USA); Gelb, A. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Chemistry). Chem. Phys. (Amsterdam); 11: No. 1, 93-98(Oct 1975).

Rotational relaxation times and collision numbers of molecular hydrogen are calculated by a classical trajectory method for five temperatures from 300-1500 K using two different potential surfaces. The differences in functional form of the two potentials are examined in order to explain the significant differences in the computed values. Comparisons are made with recent experimental results. (NL)

18402 MEASUREMENTS OF THE INFLUENCE OF THE ANGULAR DEPENDENT INTERMOLECULAR POTENTIAL ON THE TOTAL COLLISION CROSS SECTION FOR MOLECULAR HYDROGEN AND VARIOUS SCATTERING PARTNERS. Moerkerken, H.; Zandee, L.; Reuss, J. (Katholieke Universiteit Nijmegen (Netherlands). Fysisch Lab.). Chem. Phys. (Amsterdam); 11: No. 1, 87-91(Oct 1975).

For H_2 molecules colliding with Ar, Kr, Xe, CO_2, N_2 and SF_6 the total collision cross section is measured, applying state selection to the H_2 molecule. The preferential orientation of the H_2 molecule in the J = 1, m_j = 0 state is used to determine the influence of the angular dependent part of the intermolecular potential. (NL)

18403 QUANTUM MECHANICAL INVESTIGATIONS OF THE COLLINEAR COLLISIONS F + H_2 AND F + D_2 USING THE WAVEPACKET APPROACH. Zuhrt, C.; Kamal, T.; Zuelicke, L. (Central Institute of Physical Chemistry, Academy of Sciences of GDR, 1199 Berlin-Adlershof, German Democratic Republic). Chem. Phys. Lett.; 36: No. 3, 396-400(15 Nov 1975).

For a study of the quantum dynamics of the collinear collisions F + H_2 and F + D_2 a wavepacket approach is applied using three different semi-empirical potential functions due to Muckerman. The calculations give details of the time behavior of the system and, by means of a careful energy analysis, information of the partitioning of the total energy into translational and vibrational parts as well as on mean populations of product vibrational states. Pronounced quantum effects are observed. (NL)

18404 MULTIPLY-EXCITED STATES IN BEAM-FOIL SPECTROSCOPY. Berry, H. G. (Chicago Univ., Ill. (USA). Dept. of Physics). Phys. Scr.; 12: No. 1-2, 5-20(Aug 1975).

The phenomenon of the excitation of multiply-excited states in beam-foil spectroscopy is reviewed. Earlier observations of multiply-excited states and the parallel development of the theory are briefly discussed. Recent theories inspired partly by the beam-foil results are compared with other recent experimental measurements. The beam-foil photon observations are discussed. The two-electron system of the He I iso-electronic sequence forms the basis of all multiply excited systems. The agreement between theory and experiment is not nearly as conclusive for the three electron Li I system. The homologous NaI sequence poses more difficulties, and new beam-foil work in various displaced term systems is included. The autoionizing doubly-excited terms can be studied from the electron emission spectrum after beam-foil excitation. Why the beam-foil technique is so efficient at producing these multiply-excited states is discussed. The present and future aspects of atomic multiple excitation are reviewed. (NL)

18405 STUDY OF THE BEAM-FOIL EXCITATION MECHANISM USING 60-360 keV Be^+ PROJECTILES. Dynefors, B.; Martinson, I.; Veje, E. (Research Institute for Physics, Stockholm, Sweden). Phys. Scr.; 12: No. 1-2, 58-62(Aug 1975).

Beam-foil excitation functions have been measured for a number of optical transitions in Be I^a (configuration $1s^2$ 2s nl), Be I^b (configuration $1s^2$ nl n'l'), Be II^a (configuration) $1s^2$ nl), Be II^b (configuration 1s nl n'l'), and Be III^a (configuration 1s nl) in the projectile energy range 60-360 keV. The excitation functions within one level scheme were found to be proportional. They have been converted into relative population functions and the five sets of Be population functions have been linked together by only two empirically determined parameters. Comparisons to results from earlier works, using He and Li projectiles are drawn. Relative population measurements have been performed in Be I^a, Be I^b, Be II^a and Be III^a, the results are compared with earlier findings, and systematical trends are found. General conclusions about the beam-foil excitation mechanism are drawn. (NL)

18406 RADIATIVE ELECTRON CAPTURE IN HEAVY-ION COLLISIONS. Kleber, M.; Jakubassa, D. H. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Dept.). Nucl. Phys., A; 252: No. 1, 152-162(3 Nov 1975).

The cross section for radiative capture of bound electrons (REC) by fast heavy ions is calculated in (i) the impulse approximation, (ii) the impact parameter approximation and (iii) the first Born approximation. The last two methods yield the same result. It agrees with the result given by the impulse approximation in the case of small perturbation of the initial electronic state during the collision. The question how REC may be utilized to measure electronic momentum densities is investigated. For this purpose higher order effects are calculated. (NL)

18407 EFFECT OF RADIATION DIFFUSION ON THE INTENSITY OF LINES EXCITED BY AN ELECTRON BEAM PASSING THROUGH A GAS. Pavlov, P.A.; Yakhontova, V.E. Opt. Spectrosc. (USSR) 39: No. 2, 130-133 (Aug 1975).

An approximate expression is obtained for the dependence of resonance-line intensities on the thickness of the absorbing layer of gas and on the pressure when the gas is excited by an electron beam. This expression is then used to determine the effective cross sections for exciting krypton and xenon resonance lines by electrons. When 150-eV electrons were used, cross-section values of 1.3×10^{-17} cm^2 and 4.0×10^{-17} cm^2 were obtained for the 1165-Å and 1236-Å krypton lines, and 0.56×10^{-17} cm^2 and 3.2×10^{-17} cm^2 were obtained for the 1296-Å and 1470-Å xenon lines. (auth)

18408 VIBRATIONAL EXCITATION IN BENZENE BY ELECTRON IMPACT VIA RESONANCES: SELECTION RULES. Wong, S.F.; Schulz, G.J. (Department of Engineering and Applied Science, Mason Laboratory, Yale University, New Haven, Connecticut 06520). Phys. Rev. Lett. 35: No. 21, 1429-1432 (24 Nov 1975).

The vibrational excitation in the energy ranges of the lowest resonances in benzene has been measured and it is found that only few fundamental modes become excited. This selectivity of the excitation process can be understood in terms of selection rules which are based on symmetry considerations. The angular distribution of scattered electrons in the range of the lowest shape resonance (~1.2 eV) is consistent with an f_0 wave as the dominant partial wave. (auth)

18409 NONCHARACTERISTIC RADIATIONS IN ATOMIC AND MOLECULAR COLLISIONS. Chen, J.C.Y.; Ishihara, T. (Department of Physics, University of California, San Diego, La Jolla, California 92037); Watson, K.M. Phys. Rev. Lett. 35: No. 23, 1574-1577 (8 Dec 1975).

Noncharacteristic radiations in atomic and molecular collisions are examined. A new mechanism is considered in which electrons are induced to radiate collectively. The collective radiations are present even in the absence of inner-shell vacancies. The importance of this mechanism increases with collision energy and the number of electrons. The emitted photon energy increases with collision energy and can exceed the united-atom limit. The asymmetries of the noncharacteristic radiation are examined. (auth)

18410 ATOMIC FORM FACTORS, INCOHERENT SCATTERING FUNCTIONS, AND PHOTON SCATTERING CROSS SECTIONS. Hubbell, J.H. (Institute for Basis Standards, National Bureau of Standards, Washington, D.C. 20234); Veigele, Wm. J.; Briggs,

E.A.; Brown, R.T.; Cromer, D.T.; Howerton, R.J. J. Phys. Chem. Ref. Data 4: No. 3, 471-538 (16 Oct 1975).

Tabulations are presented of the atomic form factor, $F(x,Z)$, and the incoherent scattering function, $S(x,Z)$, for values of x (=sin $\theta/2)/\lambda$) from 0.005 $Å^{-1}$ to 10^9 $Å^{-1}$, for all elements Z = 1 to 100. These tables are constructed from available state-of-the-art theoretical data, including the Pirenne formulas for Z = 1, configuration-interaction results by Brown using Brown-Fontana and Weiss correlated wavefunctions for Z = 2 to 6, non-relativistic Hartree-Fock results by Cromer for Z = 7 to 100, and a relativistic K-shell analytic expression for $F(x,Z)$ by Bethe and Levinger for $x > 10$ $Å^{-1}$ for all elements Z = 2 to 100. These tabulated values are graphically compared with available photon scattering angular distribution measurements. Tables of coherent (Rayleigh) and incoherent (Compton) total scattering cross sections, obtained by numerical integration over combinations of $F^2(x,Z)$ with the Thomson formula and $S(x,Z)$ with the Klein-Nishina formula, respectively, are presented for all elements Z=1 to 100, for photon energies 100 eV (λ=124 Å) to 100 MeV (0.000124 Å). The incoherent scattering cross sections also include the radiative and double-Compton corrections as given by Mork. Similar tables are presented for the special cases of terminally-bonded hydrogen and for the H_2 molecule, interpolated and extrapolated from values calculated by Stewart et al., and by Bentley and Stewart using Kolos-Roothaan wavefunctions. (auth)

18411 DISPLACED ELECTRON ENERGIES AND THE "SHAKE-DOWN" EFFECT. Read, F. H. (Univ. of Colorado, Boulder). Radiat. Res.; 64: No. 1, 23-36(Oct 1975).

A brief review is given of the apparent exchanges of energy that can occur sometimes between the outgoing particles in electron–atom impact experiments, when these final particles consist of two electrons receding from a positive ion, and when the incident electron energy is near the energy of an autoionizing state of the target atom. These energy exchanges manifest themselves as changes in the energies of electrons ejected from autoionizing states of atoms excited by near-threshold electron impact, displacements of the thresholds for exciting autoionizing states, and structure in the cross sections for exciting Rydberg states of neutral atoms by electron impact at incident energies in the vicinity of autoionizing states. The experimental evidence for these processes is reviewed and qualitative explanations are given. Evidence for analogous effects in other scattering and absorption processes is also discussed. (auth)

18412 "PHOTOELECTRON" SPECTROSCOPY BY ELECTRON IMPACT. Coincidence Studies of Scattered and Ejected Electrons. Brion, C. E. (Univ. of British Columbia, Vancouver). Radiat. Res.; 64: No. 1, 37-52(Oct 1975).

The quantitative relation between fast electron impact and photoabsorption is discussed with reference to simulation of the technique of photoelectron spectroscopy. An apparatus is described that employs coincidence detection of scattered and ejected electrons resulting from ionization over a range of energy losses up to 70 eV. Absolute oscillator strengths are reported for total absorption and ionization to electronic states of water and ammonia. Relative state populations are in good agreement with photoelectron spectroscopy at 584 A. Angular distribution parameters are measured for neon, argon, and krypton. (auth)

18413 MEASUREMENTS OF THE ENERGY AND ANGULAR DISTRIBUTION OF SECONDARY ELECTRONS. Beaty, E. C. (Univ. of Colorado, Boulder). Radiat. Res.; 64: No. 1, 70-79 (Oct 1975).

Measurements have been made of the distribution in energy and angle of secondary electrons from ionizing collisions of electrons with several atoms and molecules. Such data have been published for a wide range of the relevant variables. Some of these measurements have now been repeated in other laboratories. Some recent interpretive efforts also reveal trends in the data that were not previously apparent. (auth)

18414 ENERGY AND ANGULAR DISTRIBUTIONS OF ELECTRONS FROM ATOMS AND MOLECULES BY ELECTRON IMPACT. Oda, N. (Tokyo Inst. of Tech.). Radiat. Res.; 64: No. 1, 80-95(Oct 1975).

Some experimental results on cross sections, differential in energy and angle, for electrons scattered or ejected from helium, methane, carbon monoxide, and water by intermediate-energy electron impact are presented, and the doubly differential cross section for helium is compared with theoretical calculations for models such as the scaled Born approximations with and without interference, the plane-wave Born approximation, the Born approximation,with the Roothaan ground state wave function, and the binary encounter theory, resulting in a fairly good agreement between experiment and theory for the Born approximations except in the case of the plane-wave Born approximation. The experimental doubly differential cross sections are integrated over angles to derive the singly differential cross sections, differential only in energy, which are compared with the Mott cross sections corrected for binding energies of orbital electrons. Finally, the bearings of the measurement of doubly differential cross sections on the description of the track structure, the electron slowing-down spectra, the total ionization cross sections, and the stopping power for lower energy electrons are discussed. (auth)

18415 ENERGY DISTRIBUTION OF SECONDARY ELECTRONS. Kim, Y. K. (Argonne National Lab., IL). Radiat. Res.; 64: No. 1, 96-105(Oct 1975).

A simple method for constructing a consistent set of secondary-electron spectra from related theoretical and experimental data is reviewed. The method enables one to extend the spectra to the range of variables (e.g., primary and secondary-electron energies) not covered by experimentation. As an illustration, recommended spectra for electron impact on He and N_2 are presented. For incident protons of moderate energy (less than 300 keV) charge transfer to the hydrogen continuum accounts for a substantial fraction (less than 25 percent) of the total ionization cross section. Suggestions are given for desirable experiments that would be useful in determining reliable secondary-electron spectra. (auth)

18416 ROLE OF SECONDARY ELECTRONS IN CHARGED PARTICLES DEGRADATION. Green, A. E. S. (Univ. of Florida, Gainesville). Radiat. Res.; 64: No. 1, 119-140(Oct 1975).

A fundamental description of charged particle deposition phenomena must include detailed characterizations of the production and interactions of secondary electrons which arise along the track of a primary particle. Since these secondary electrons predominately have energies below that describable by the Born approximation, one must go beyond the Bethe theory of stopping power and adopt a detailed microscopic approach. In this paper, work since 1963 involving secondary electron distributions is reviewed, beginning with the work of Green and Barth, largely in relation to applications but also in relation to the fitting of experimental data and the testing of theoretical models. In the latter context, the independent particle model of Green, Sellin, and Zachor in Born approximation and in the Eikonal approximations are utilized. (44 refs.) (auth)

18417 MECHANISMS OF ELECTRON PRODUCTION IN ION-ATOM COLLISIONS. Rudd, M. E. (Univ. of Nebraska, Lincoln). Radiat. Res.; No. 1, 153-180(Oct 1975).

The usefulness of cross sections differential in the angle and energy of ejected electrons in showing the several mechanisms of electron ejection is pointed out. These mechanisms are direct Coulomb ejection of inner- and outer-shell electrons, charge transfer to continuum states, autoionization and Auger emission, and electron promotion followed by Auger emission. Examples of distributions of electrons are given for various projectiles, targets, and energies. Recent improvements in the theoretical treatments are noted. Dependence of the Auger cross sections on projectile type and energy are discussed. Satellite production and its effect on fluorescence yield are considered. (55 refs.) (auth)

Atomic Theory

Refer also to abstract 18384.

18418 (LYCEN-7536) CLEBSCH-GORDAN COEFFICIENTS FOR CHAINS OF GROUPS OF INTEREST IN QUANTUM CHEMISTRY. Kibler, M. R.; Guichon, P. A. M. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire). May 1975. 33p. INIS.

The algebra of the representation of the special unitary group SU(2), the universal covering of the proper rotation group SO(3), is studied in a non-standard basis, adapted to a chain of type SU(2) contains ... contains G'' contains G' contains G. The introduction of such a chain enables to label, at least partially, the elements of the irreductible tensorial sets under SU(2) with irreducible representations of G, G' G'' .... The restriction SU(2) → ... → G'' → G' → G is introduced in the Wigner-Racah algebra of the group SU(2). The physical interest lies in the fact that the double group of any point symmetry group belongs, up to an isomorphism, to the considered chain. The formalism described appears to be useful in molecular and solid-state calculations. It is particularly efficient in the fields of vibrational-rotational and electronic spectroscopy of molecules. (FR)

18419 (LYCEN-7537) TABLES OF CLEBSCH-GORDAN COEFFICIENTS ADAPTED TO THE CUBICAL, TETRAGONAL AND DIGONAL DOUBLE GROUPS. Kibler, M. R.; Guichon, P. A. M. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire). May 1975. 47p. INIS.

Some basic considerations on the Clebsch-Gordan coefficients adapted to a chain of sub-groups of the universal covering SU_2

of the proper rotation group SO_3 are reviewed. Extensive tables of Clebsch-Gordan coefficients adapted to a chain isomorphic to SU_2 contains O′ contains D′4 contains D′$_2$ are presented for consultation. These coefficients are useful in various fields of molecular spectroscopy, particularly in the ligand field theory. The tables listed here constitute an extensive tabulation of coupling coefficients of molecular interest. (FR)

18420 CONVEXITY PROPERTIES OF COULOMB SYSTEMS. Thirring, W. (Univ., Vienna). Acta Phys. Austriaca, Suppl.; 14: 631-642(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

Convexity properties of Coulomb systems is calculated for atoms, molecules, mass dependence, and atomic and molecular hydrogen. It is found that concavity is easier to verify than analyticity and has numerically more useful consequences. (JFP)

18421 QUASICLASSICAL SELECTION OF INITIAL COORDINATES AND MOMENTA FOR A ROTATING MORSE OSCILLATOR. Porter, R. N. (State Univ. of New York, Stony Brook); Raff, L. M.; Miller, W. H. J. Chem. Phys.; 63: No. 5, 2214-2218(1 Sep 1975).

The classical orbits of a rotating Morse oscillator are calculated by means of Hamilton–Jacoby theory after truncating the Hamiltonian to permit analytical solution. Except at very high J, the approximate analytic orbit for the radial coordinate is in good agreement with that obtained by numerical integration of the exact equations of motion. Bohr quantization gives an expression for the rotation-vibration energy correct through quadratic terms in $(v+\frac{1}{2})$ and $J(J+1)$, where v and J are the vibrational and rotational quantum numbers, respectively. The principal result is an analytic prescription for obtaining values of the coordinates and momenta, given v, J, and a set of random numbers, that facilitates properly weighted quasiclassical selection of initial states of diatomic molecules in trajectory calculations. (auth)

18422 ADIABATIC FORMULAS FOR SUPERFLUORESCENCE. Benza, V.; Lugiato, L. A. (Univ., Milan). Nuovo Cim., B; 30B: No. 1, 80-86(11 Nov 1975).

A two-level atomic system giving rise to single-pulse cooperative spontaneous emission (superfluorescence or superradiance) is considered. The most general adiabatic formula, reducing the expectation values of field observables and atom-field correlations to expectation values of atomic observables, is deduced. The effects of inhomogeneous broadening and finite temperature are analyzed. (auth)

18423 RESONANCE TWO-QUANTUM PROCESSES. Demidenko, Z. A. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 9, 1432-1438(Sep 1975). (In Russian).

Stimulated resonance two-quantum processes probabilities are derived by the method of density matrix in the relaxation time approximation. For a case of a large detuning, the difference between two types of two-quantum transition probabilities is shown. (auth)

18424 DAMPING OF STATES IN THE PROBLEM OF INTERSECTING TERMS. Bazylev, V. A.; Zhevago, N. K. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 3, 853-859(Sep 1975). (In Russian)

The effect of damping of states on the transition between quasi-intersecting terms is investigated by solving the Schroedinger equation in the energy representation with a model Landau–Ziner hamiltonian. It is shown that damping of states may lead to a significant change in the time variation of the reaction amplitude compared to the case when damping is negligible. The effective region of term interaction is also effected. However damping of states does not affect (if the trivial $e^{-2\Gamma t}$ dependence is disregarded) the probability to remain in the initial state or the probability for transition to another state during a period exceeding the effective transition time. (auth)

18425 COLLECTIVE EXCITATIONS OF HEAVY ATOMS. Gadiyak, G. V.; Kirzhnits, D. A.; Lozovik, Yu. E. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 1, 122-130(Jul 1975). (In Russian)

It is shown that the excitation spectrum of the electron shell of a heavy atom contains, along with one-particle levels, two collective levels of the dipole type with a relatively small width. In a first approximation the levels correspond to oscillations of the atom core with respect to the nucleus. The collective levels are optically active, the lower of them possessing an appreciable oscillator strength. The respective excitation energies are of the order of Z Ry (Z is the atomic number) and correspond to the far ultraviolet region (soft x-rays). (auth)

18426 PARTICLE WITH LOW COUPLING ENERGY IN A CIRCULARLY POLARIZED FIELD. Manakov, N. L.; Rapoport, L. P. (Voronezh State Univ., USSR). Zh. Eksp. Teor. Fiz.; 69: No. 3, 842-852(Sep 1975). (In Russian)

Parameters of the quasistationary state of a particle with low coupling energy E_0 in the field of a monochromatic circularly polarized electromagnetic wave of frequency ω are evaluated. By transforming to a coordinate system which rotates with a frequency equal to that of the field, it is possible to obtain a transcendental equation for the complex energy whose real and imaginary parts yield the position and width of the level. In the approximation with $\omega \ll \omega_0$ and $F \ll F_0$ (F is the field amplitude, ω_0 and F_0 the respective atomic quantities) the level shift is quadratic with respect to F and the width is the same as that obtained in the adiabatic approximation. For arbitrary ω an expansion of $\sqrt{E}$ into a field intensity is obtained. It is shown that the condition of applicability of perturbation theory for the level width Γ is $\gamma^2 \ll 1/K_0^3$ where $\gamma = eF/\omega(2mE_0)^{1/2}$, $K_0 = \sqrt{2E_0}/\hbar\omega$. Corrections to the first nonvanishing order in perturbation theory are calculated for the level shift and width. Results of numerical calculations for the parameter $\gamma \approx 1$ are presented. Applicability of the results to negative ions is discussed. (auth)

18427 DIRAC EQUATIONS WITH AN EXACT HIGHER SYMMETRY. Bell, J. S. (European Organization for Nuclear Research, Geneva (Switzerland)); Ruegg, H. (Geneva Univ. (Switzerland). Inst. de Physique Theorique). Nucl. Phys., B; 98: No. 1, 151-153(27 Oct 1975).

A family of external potentials for the Dirac equation is exhibited for which there is an exact SU(2) symmetry leading to exact spin–orbit doublet degeneracy. The family in question includes an equal superposition of Coulomb-like and Lorentz-scalar potentials. (NL)

18428 QUANTUM SCATTERING FROM A SINUSOIDAL HARD WALL: ATOMIC DIFFRACTION FROM SOLID SURFACES. Masel, R.I.; Merrill, R.P. (Department of Chemical Engineering, University of California, Berkeley, California 94720); Miller, W.H. Phys. Rev. B 12: No. 12, 5545-5551 (15 Dec 1975).

An exact quantum formalism for atom scattering from a sinusoidal hard-wall surface is presented. The Lippmann-Schwinger equation is solved for a scattering kernel consistent with the hard-wall boundary conditions on the Schrödinger equation. It results in an infinite-dimensional matrix equation for the Fourier coefficients of the scattering kernel which can be solved in a finite-dimensional limit to convergence. The results show either rainbow or specular patterns depending on the surface roughness and incident k vector, as predicted by semiclassical and coupled-channel calculations. Bragg-like structure is present with the periodicity of the amplitude of the sinusoidal hard wall and the effects of multiple scattering are evidenced at large surface amplitudes. (auth)

18429 USE OF THE *LL* COUPLING SCHEME IN CALCULATIONS OF TERM POSITIONS FOR *f*-ELECTRON CONFIGURATIONS. Kroshilin, A.E.; Tolmachev, V.V. Opt. Spectrosc. (USSR) 39: No. 2, 119-122 (Aug 1975).

Coulombic interaction matrices are calculated for hydrogenlike $4f$ and $5f$ orbitals in a scheme involving *LL* coupling of configurations and groups of terms of $f^n([11]L_A\times[1]3)L$ (for L=2–6), $f^n([1111]L_A\times[1]3)L$ (for L=1–7), $f^n([11111]L_A\times[1]3)L$ (for L=2–6), and $f^n([11111]L_A\times[11]L_B)L$ (for L=2–8). The effectiveness of the pure *LL* coupling scheme is evaluated. (auth)

18430 QUASIPOTENTIAL APPROACH TO THE COULOMB BOUND STATE PROBLEM FOR SPIN-0 AND SPIN-$\frac{1}{2}$ PARTICLES. Rizov, V. A. (European Organization for Nuclear Research, Geneva (Switzerland)); Todorov, I. T. (Institute for Advanced Study, Princeton, N. J. (USA)); Aneva, B. L. (Bylgarska Akademiya na Naukite, Sofia. Inst. za Yadrena Izsledvaniya i Yadrena Energetika). Nucl. Phys., B; 98: No. 3, 447-471(10 Nov 1975).

A recently proposed local quasipotential equation is reviewed and applied to the electromagnetic interaction of a spin-0 and a spin-$\frac{1}{2}$ particle. The Dirac particle is treated in a covariant two-component formalism in the neighborhood of the mass shell. The fine structure of the bound-state energy levels and the main part of the Lamb shift (of order $\alpha^5 \ln(1/\alpha)$ are evaluated with full account of arelativistic recoil effects (without using any inverse mass expansion)). Possible relevance of the techniques developed to fine structure calculations for meso-atomic systems is pointed out. (NL)

18431 NATURE OF SECONDARY ELECTRONS CREATED AS THE RESULT OF ELECTRON SHAKE-OFF AND VACANCY CASCADES. Carlson, T. A. (Oak Ridge National Lab., TN). Radiat. Res.; 64: No. 1, 53-69(Oct 1975).

Two sources of secondary electrons that are concomitant with most ionization phenomena and produce electrons in addition to the primary ionization event are: (1) electron shake-off and (2) vacancy cascades. Electron shake-off is the promotion of an electron into the continuum because of a sudden change in the

central potential of an atom, caused, for example, by the loss of a shielding electron. A vacancy cascade is a series of Auger processes that ensue from the creation of a vacancy in the inner shell of an atom. A review of the nature of these sources of ionization and the energy and intensity distribution of secondary electrons that result from them is given. Suggestions are given for future experimental and theoretical developments. 25 refs (auth)

PHYSICS (ELECTROFLUID AND MAGNETOFLUID)

Refer also to abstract 17006.

18432 THEORETICAL ARGUMENT AGAINST A BOSE–EINSTEIN CONDENSATE IN SUPERFLUID ^{4}He. Evans, W. A. B. (Kent Univ., Canterbury, Eng.). Nuovo Cim., B; 30B: No. 1, 145–152(11 Nov 1975).

Recent high-momentum-transfer inelastic neutron scattering measurements on superfluid ^{4}He yield lineshapes that have been argued to be consistent with the absence of any Bose-Einstein condensation. Here we lend theoretical support to this viewpoint by demonstrating rigorously that no Bose-Einstein condensation can exist within the hierarchy of self-consistent approximations for the single-body propagator in an interacting Bose system. The implications of this on our understanding of superfluidity are discussed. (auth)

18433 THERMODYNAMIC PROPERTIES OF LIQUID ^{3}He–^{4}He MIXTURES NEAR THE TRICRITICAL POINT. II. Data Analysis by the Scaling-Field Method. Riedel, E. K.; Meyer, H.; Behringer, R. P. (Duke Univ., Durham, NC). J. Low Temp. Phys.; 22: No. 3/4, 369-402(Feb 1976).

The scaling theory for tricritical phenomena by Riedel is applied to the analysis of thermodynamic properties of liquid ^{3}He–^{4}He mixtures near the tricritical point. Within this theory experimental data for the phase diagram, the ^{3}He molar concentration X, and the concentration susceptibility S are discussed in terms of two scaling fields that are functions of the temperature T and the difference DELTA of the chemical potentials of the two helium isotopes. The quantities X and S in terms of the fields T and DELTA as independent variables are obtained for the intervals -0.1 less than T–T/sub t/ less than 0.53 K and -9 less than DELTA–DELTA/sub t/ less than 0.8 J/mole, from vapor pressure and calorimetric data. The transformed data are analyzed to yield the tricritical exponents, amplitudes, scaling fields, and scaling functions. The values of the tricritical exponents are found to agree with those predicted by the renormalization-group theory of Riedel and Wegner. (Logarithmic corrections are beyond the precision of the present experiment.) Relations between amplitudes are derived and tested experimentally. The (linear) scaling fields are determined by using their relationship to geometrical features of the phase diagram. The data for X and S are found to scale in terms of these generalized scaling variables. The sizes of the tricritical scaling regions in the normal and superfluid phases are estimated; the range of apparent tricritical scaling is found to be appreciably larger in the normal-fluid phase than in the superfluid phase. The tricritical scaling function for the concentration susceptibility is compared with the analogous scaling function for the compressibility of pure ^{3}He near the critical gas–liquid phase transition. Finally, when the critical line near the tricritical point is approached along a path of constant DELTA less than DELTA/sub t/, the experimental data are found to exhibit the onset of the crossover from tricritical to critical behavior in qualitative agreement with crossover scaling. (auth)

18434 FLUCTUATIONS ABOVE THE SUPERFLUID TRANSITION IN LIQUID ^{3}He. Emery, V. J. (Brookhaven National Lab., Upton, NY). J. Low Temp. Phys.; 22: No. 3/4, 467-478 (Feb 1976).

It is shown that fluctuations above the superfluid transition in liquid ^{3}He depend strongly upon the relative angular momentum l for which Cooper pairing occurs. The effects may be calculated for any value of l and they should be observable in the static magnetization, viscosity, and spin diffusion coefficient, giving a means of determining l. Conclusions to be drawn from existing experiments are discussed. (auth)

18435 KAPITZA CONDUCTANCE OF THE (100) SURFACE OF COPPER. Snyder, N. S. (National Bureau of Standards, Boulder, CO). J. Low Temp. Phys.; 22: No. 3/4, 257-284(Feb 1976).

Measurements of the Kapitza conductance to liquid helium II across the (100) surface of single crystals of copper are presented. The temperature range of these measurements was 1.6–2.1 K. The sample surfaces were subjected to several different treatments. Some surfaces were cleaned by low-energy argon ion bombardment, annealed in an ultrahigh-vacuum system, and preserved under vacuum until purified liquid helium was admitted. Other surfaces were intentionally damaged by machining and/or exposure to the atmosphere. The conductance after these latter treatments was found to be about a factor of three higher than that of the more ideally cleaned and annealed surfaces, and a significant difference in the temperature dependence of the conductance was also observed. Conductances were reproducible for similarly treated surfaces and could be correlated with surface damage determined by x-ray diffraction. The relationship of these results to the numerous current theories of the Kapitza conductance is discussed. Conductance measurements of polycrystalline indium, which was used as a sealant, are presented. 7 figures, 1 table, 53 references. (auth)

18436 ORBITAL MODES IN SUPERFLUID ^{3}He. Maki, K.; Ebisawa, H. (Univ. of Southern California, Los Angeles). J. Low Temp. Phys.; 22: No. 3/4, 285-292(Feb 1976).

The equation describing the rotation of the orbital coordinate in superfluid ^{3}He is obtained. It is shown that the orbital modes obey a diffusion-like equation with a finite energy gap. The transient behavior of the l vector in the A phase after the d vector is suddenly rotated is considered. 4 figures. (auth)

18437 SHAPE ANALYSIS OF PULSED SECOND SOUND IN He II. Worthington, T.; Yan, J.; Trefny, J. U. (Wesleyan Univ., Middletown, CT). J. Low Temp. Phys.; 22: No. 3/4, 293-300(Feb 1976).

Second sound in He II has been observed using a heat pulse method. At temperatures where well-developed second sound is observed, the entire pulse shape can be understood if heat sources and geometrical effects are properly taken into account. 4 figures. (auth)

18438 DYNAMICAL EFFECTS IN SUPERFLUID HELIUM-4. Ahmad, M. (Kashmir Univ., Srinagar, India). Czech. J. Phys.; 25: No. 10, 1127-1138(1975).

The close structural similarity between the commutation relations of harmonic oscillator operators and the operators for Bose fields is exploited to study the excitation spectrum in superfluid helium-4. By applying the "broken symmetry" condition it is shown how the creation of phonons gives rise to the superfluid behavior of liquid ^{4}He. The energy gap needed for roton excitation is derived. (auth)

18439 THEORY OF SOLUTION OF A SUPERFLUID FERMI LIQUID IN A SUPERFLUID BOSE LIQUID. Volovik, G. E.; Mineev, V. P.; Khalatnikov, I. M. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 2, 675-687(Aug 1975). (In Russian).

The solution of an isotropic superfluid fermi liquid in a superfluid bose liquid is considered in the spirit of the Landau theory of a fermi liquid. A three-velocity hydrodynamics of such a solution is derived in the limit $\omega\tau \ll 1$ on basis of the kinetic equation obtained for the fermi particle distribution function. Acoustic solutions of the hydrodynamic equations are obtained and the temperature dependence of velocities of first, second, third and two fourth sounds is investigated at all temperatures. In the high frequency limit $\omega\tau \gg 1$ two acoustic solutions of the kinetic equation are obtained, one of them going over to zero sound at $T > T_c$ in a solution of a normal fermi liquid in a bose liquid. All physical quantities are expressed in terms of fermi liquid constants. The problem of critical velocities of a solution of a superfluid fermi liquid in a superfluid bose liquid is investigated. (auth)

18440 INTERSECTION OF TRANSITION LINES OF THE SECOND KIND. Lyuksyutov, I. F.; Pokrovskii, V. L.; Khmel'nitskii, D. E. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1817-1824(Nov 1975). (In Russian).

The nature of phase diagrams on intersection of two lines of phase transitions of the second kind is discussed. After an exposition of results of the Landau theory for this case the problem of the effect of critical fluctuations is investigated. The problem of asymptotic asymmetry of the hamiltonian at the intersection point is solved by the Wilson method. A qualitative investigation of the renormalization group equations yields a description of some possible types of phase diagrams. Interaction of superfluid transition lines and the metastability limits of helium isotope solutions are also considered. (auth)

18441 MUTUAL FRICTION BETWEEN THE NORMAL COMPONENT AND VORTICES IN ROTATING SUPERFLUID HELIUM. Sonin, E. B. (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksp. Teor. Fiz.; 69: No. 3, 921-935(Sep 1975). (In Russian)

The Hall–Vinen theory of attenuation of second sound in rotating helium, its derivation and limits of applicability are discussed. It is demonstrated that the Iordansky force should be added to the transverse friction of phonons only if their scattering cross section is determined by the usual procedure as the square of the scattering amplitude in the Born approximation. It is not necessary to add the Iordansky force in the case of rotons for which the scattering cross section is determined by classical scattering

theory. The resulting transverse forces for rotons and phonons then turn out to be the same and equal to the Iordansky force. The correction to the friction of phonons on vortexes due to proper oscillations of the vortex filament is determined. (auth)

18442 THREE-VELOCITY HYDRODYNAMICS OF SUPERFLUID SOLUTIONS. Andreev, A. F.; Bashkin, E. P. (Inst. of Physical Problems, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 1, 319-326(Jul 1975). (In Russian)

The three-velocity hydrodynamics equations describing the properties of solutions of ^{3}He in liquid ^{4}He below the Fermi component transition point to the superfluid state are defined by prescribing the thermodynamic functions and 2×2 symmetric matrix which plays the role of density of the superfluid part. Calculation of the elements of the matrix is carried out on basis of the BCS theory. The result is that each of the two superfluid motions is accompanied by transfer of both solution components. The velocities of all three types of sound oscillations are calculated. (auth)

18443 KINETIC PROPERTIES OF THE B-PHASE OF SUPERFLUID ^{3}He. Geilikman, B. T.; Chechetkin, V. R. (Moscow Physical-Technical Inst.). Zh. Eksp. Teor. Fiz.; 69: No. 1, 286-296(Jul 1975). (In Russian)

The temperature dependence of the viscosity, thermal conductivity and absorption coefficients of zero sound is found on basis of the Balian–Werthamer state with unit momentum. The calculations are carried out by means of the kinetic equation for quasiparticle excitations in the superfluid state derived by the u–v transformation technique. It is shown that the results obtained do not depend significantly on the choice of the model or on the magnitude of the Cooper pair orbital momentum. The temperature dependence derived is in agreement with available experimental data. (auth)

18444 MAGNETIC KAPITZA CONDUCTANCE AT THE INTERFACE BETWEEN SUPERFLUID PHASES OF LIQUID ^{3}He AND MAGNETIC SUBSTANCES. Maki, K. (University of Southern California, Los Angeles (USA). Dept of Physics); Mills, D. L. (California Univ., Irvine (USA). Dept. of Physics); Beal-Monod, M. T. (Paris-11 Univ., 91 – Orsay (France). Lab. de Physique des Solides). Phys. Lett., A; 54: No. 5, 381-382(6 Oct 1975).

The Kapitza conductances at the interface between superfluid phases (A and B) of liquid ^{3}He and magnetic substance are computed and compared with the one when liquid ^{3}He is in the normal phase. (NL)

18445 ANOMALOUS ROTON-INDUCED DRAG ON NEGATIVE IONS IN He II. Allum, D. R.; McClintock, P. V. E.; Phillips, A. (Lancaster Univ. (UK)). Phys. Lett., A; 54: No. 5, 385-386 (6 Oct 1975).

Measurements have been made of the drift velocities v of negative ions moving through pressurized He II as a function of electric field E. In the roton-dominated temperature range the effective mobility $\mu = v/E$ is found to increase with increasing E. (NL)

18446 CONVECTION DRIVEN T_1 IN ^{3}He–^{4}He MIXTURES. Lucas, P.; Penman, D. A.; Tyler, A. (Manchester Univ. (UK)). Phys. Lett., A; 54: No. 5, 387-388(6 Oct 1975).

In a controlled experiment of high temperature resolution the authors have shown that the nuclear magnetic relaxation time, T_1, of the ^{3}He in a liquid helium isotopic mixture is shortened in the presence of convection at the superfluid transition temperature. (NL)

18447 HYDRODYNAMICS OF ^{3}He NEAR THE *A* TRANSITION. Liu, M. (Physik-Department der Technischen Universität, München, Germany). Phys. Rev. Lett. 35: No. 23, 1577-1580 (8 Dec 1975).

The hydrodynamics of ^{3}He-*A* in the vicinity of the phase transition is generalized to include an extra variable, the magnitude of the order parameter. Its equation of motion is derived and added to the set of hydrodynamic equations. The effect on the dissipation and dispersion of first, second, and fourth sound is calculated. First sound is found to be anisotropic and a pair of new propagating modes is predicted. (auth)

18448 SURFACE TENSION AND BOUNDARY CONDITIONS FOR SUPERFLUID FERMI LIQUID. SIZE EFFECT AND THE EFFECT OF A MAGNETIC FIELD ON THE PHASE DIAGRAM. Privorotskii, I.A. (Department of Physics, Technion–Israel Institute of Technology, Haifa, Israel). Phys. Rev. B 12: No. 11, 4825-4829 (1 Dec 1975).

The boundary conditions for the Ginzburg-Landau equations for an anisotropic superfluid Fermi liquid are obtained. The surface tension is taken into account. The observable surface tension is calculated for the simplest cases. It is shown that surface tension can lead to a profound effect on the phase diagram which is analogous to the one observed in a magnetic field. The influence of a magnetic field on the phase diagram is also calculated. (auth)

18449 RELAXATION-TIME APPROXIMATION FOR SOUND ATTENUATION IN SUPERFLUID ^{3}He. Combescot, R. (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York 14853). Phys. Rev. B 12: No. 11, 4839-4846 (1 Dec 1975).

The sound attenuation due to collisions in superfluid ^{3}He is studied, using for the collision integral a simplifying ansatz which satisfies conservation laws. In the zero-sound regime, attenuation and velocity are fairly frequency independent; this supports the idea that collisions can be accounted by a mere background in sound attenuation. In the first-sound regime, the viscosity tensor is studied (in the *A* phase) and its low-temperature behavior investigated. (auth)

18450 SECOND-SOUND ATTENUATION IN A SUPERCRITICAL COUNTERFLOW JET. Laguna, G.A. (California Institute of Technology, Pasadena, California 91109). Phys. Rev. B 12: No. 11, 4874-4881 (1 Dec 1975).

The attenuation of a beam of high-frequency second sound traversing a counterflow jet in liquid helium has been measured in the temperature range 1.6–2.06°K. Combined use of thin-film superconducting thermometers with specially developed low-noise amplifiers allowed resolution of the second-sound amplitude to better than one part in 10^8°K. The additional attenuation due to the jet was found to be less than 10% of the predicted value using the theory of mutual friction in a supercritical counterflow, and consistent with the result of earlier temperature-gradient and ion-beam attenuation measurements. (auth)

18451 ORBITAL WAVES IN THE *A* PHASE OF SUPERFLUID ^{3}He. Combescot, R. (Laboratory of Atomic and Solid State Physics, Cornell University, Ithaca, New York 14853). Phys. Rev. Lett. 35: No. 24, 1646-1649 (15 Dec 1975).

Orbital waves in the *A* phase of superfluid ^{3}He are shown to be essentially diffusive. The weak-coupling expression for the "angular superfluid density" tensor $\underline{C}$ is obtained. (auth)

18452 SUPERFLUID DENSITY IN POROUS VYCOR GLASS. Kiewiet, C.W.; Hall, H.E. (Physics Department, Schuster Laboratory, The University, Manchester M13 9PL, England); Reppy, J.D. Phys. Rev. Lett. 35: No. 19, 1286-1289 (10 Nov 1975).

The superfluid density of ^{4}He confined to porous Vycor glass has been determined from fourth-sound measurements over a temperature range from below 0.1 K to within 10 mK of the transition. For temperatures below 1.4 K the normal-fluid fraction can be described in terms of a roton contribution with gap $\Delta/k_B = 5.85$ K and a "one-dimensional," T^2, phonon contribution. Near the transition temperature, $T_c = 1.955$ K, the superfluid density is found to vary as $(T_c - T)^\zeta$ with $\zeta = 0.65 \pm 0.03$. (auth)

18453 VORTEX VELOCITY IN TURBULENT He II COUNTERFLOW. Ashton, R.A.; Northby, J.A. (Department of Physics, University of Rhode Island, Kingston, Rhode Island 02881). Phys. Rev. Lett. 35: No. 25, 1714-1717 (22 Dec 1975).

We have used the ion-vortex interaction to measure the drift velocity of the vorticity present in turbulent counterflow, and find that it moves in the direction of normal-fluid flow. The result is in direct conflict with a central assumption of the presently accepted model of the turbulent state. (auth)

18454 EXPERIMENTAL INVESTIGATIONS OF LIQUID ^{4}He IN SMALL ASSEMBLIES. Gregory, S. Waterloo, Ont.; Univ. of Waterloo (1975). vp. Univ. of Waterloo Library.

Thesis (Ph. D.).

The velocity of fourth-sound for liquid helium contained in Vycor porous glass has been measured by a standing wave technique and from this velocity the temperature-dependence of the superfluid fraction has been calculated. It was found that this temperature-dependence is very similar to that of bulk helium, but that the superfluid onset temperature is considerably reduced below that of bulk helium. A fundamental restriction on the closeness with which one can approach the onset temperature in the present set-up has been observed, in that the amplitudes of the fourth-sound fundamental resonance signals fall to zero at temperatures considerably below the onset temperatures defined by ρ_s/ρ T curves. The importance of the cleanliness of the Vycor specimens is stressed and the neglect of adequate cleaning and installation precautions is shown to be reflected quite characteristically in fourth-sound data. Porous glass has been made in the laboratory, but unfortunately the only really satisfactory specimen appeared to give a superfluid onset temperature below the experimentally accessible temperature range of the present apparatus. A low-frequency response similar to that reported by workers at U.C.L.A. has been seen and some of its properties investigated. The phenomenon remains unexplained, but a suggestion of the kind of mechanism which might be responsible for it is offered. The present theoretical understanding of both fourth-sound and finite-size effects in liquid helium is reviewed and experimental results from the present and other work are discussed in the light of this understanding. (Diss. Abstr. Int., B)

18455 ENTRY FLOW IN A CHANNEL AND MHD FLOW IN A PLANE CHANNEL UNDER STRONG TRANSVERSE MAGNETIC FIELDS. Kapila, A. K. Ithaca, NY; Cornell Univ. (1975). 163p. University Microfilms Order No. 75-24,203.

Thesis (Ph. D.).

The problem of entry flow is reexamined using a new model: a single channel forming an inlet in an otherwise uniform stream. This model permits one to account for the upstream disturbance caused by the inlet, a feature not present in any previous investigation. The flow field is computed to second order, in the sense of modern boundary-layer theory, and its asymptotic character determined close to the inlet and far down stream. It is shown that none of the models previously used in the literature correctly predicts both the drag and the separation force on the walls. The flow caused by a global circulation around the channel walls is also discussed. MHD flow in plane channels under strong transverse magnetic fields are examined. Of particular interest are the flows where the "inertialess approximation" (hitherto the basis of almost all duct-flow studies) is not valid everywhere in the flow field. The breakdown occurs in thin layers which arise, for example, when the channel walls change slope abruptly or when bluff bodies are present in the channels. The linear analysis of Hunt and Leibovich, originally limited to finite wall slopes, is extended to include large wall slopes as well as sudden bumps in the channel. The specific case of the lower wall of the channel having a forward-facing step, where a nonlinear equation governs the inertial layer, is also studied. From similarity considerations it is shown that a stagnant separation bubble will form at the top corner of the step. Attempts to solve numerically the inertial layer equations and the full MHD equations are also described. (Diss. Abstr. Int., B)

PHYSICS (HIGH-ENERGY)

18456 HIGH-ENERGY PHYSICS. Malamud, E.; Nezrick, F. (Fermi National Accelerator Laboratory). Phys. Today 28: No. 11, 25-35 (Nov 1975).

Sharing of accelerators and technologies has led to joint studies involving interactions of pions, protons and neutrinos. (auth)

Particle Interactions and Properties (Experimental)

Refer also to abstracts 18534 and 18758.

Electromagnetic

Refer also to abstract 18646.

18457 SOURCE THEORY VIEWPOINTS IN DEEP INELASTIC SCATTERING. Schwinger, J. (Univ of California, Los Angeles). Acta Phys. Austriaca, Suppl.; 14: 471-488(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

The phenomena of deep inelastic electron scattering on single nucleons, viewed as virtual photon absorption, are reexamined with the nonspeculative, phenomenological attitude of source theory. (JFP)

18458 INVESTIGATION OF ELECTRON–PHOTON SHOWERS IN A MULTILAYER X-RAY-FILM EMULSION CHAMBER. Amineva, T. P.; Varkovitskaya, A. Ya.; Dubrovina, S. A.; Ivanova, M. A.; Nikol'skii, S. I.; Nit, K. F.; Rakobol'skaya, I. V.; Cherdyntseva, K. V. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1802-1806(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 2024-2029(Sep 1970).

The various distributions and fluctuations in the development of electron–photon showers in a multilayer x-ray film emulsion chamber are considered. (JFP)

18459 INVESTIGATION OF THE RADIO EMISSION OF EXTENSIVE AIR SHOWERS AT THE MOSCOW STATE UNIVERSITY COMPREHENSIVE FACILITY: LATERAL DISTRIBUTION AND POLARIZATION OF THE RADIO EMISSION. Vernov, S. N.; Khristiansen, G. B.; Abrosimov, A. T.; Atrashkevich, V. B.; Vedeneev, O. V.; Nit, K. F. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1776-1779(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1995-1999(Sep 1970).

A comparison of data on the polarization of EAS radio emission with the various theories is shown. The lateral distribution of radio flux in individual showers is also shown. It is indicated that the geomagnetic mechanism is the chief, though probably not the only source of EAS radio emission. It is found that the radio emission at 30 MHz falls sharply at large distances from the shower axis. (JFP)

18460 PHENOMENOLOGICAL CHARACTERISTICS OF EXTENSIVE AIR SHOWERS AT SEA LEVEL. Vernov, S. N.; Khristiansen, G. B.; Vedeneev, A. V.; Kalmykov, N. N.; Kulikov, G. V.; Solov'eva, V. I. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1780-1782(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 2000-2002(Sep 1970).

Data are presented on the lateral distribution functions for electrons and muons with $E_\mu > 10$ GeV in showers with particle numbers $N_e > 1 \times 10^7$. The experimental results were obtained for showers detected by the apparatus with a probability >0.95 and having a zenith angle $\theta < 30°$. For each shower detected the position of the axis, the total number of particles N_e, and the age parameter s were found. Then the s distribution was constructed for showers with given N_e. The muon lateral distribution function is also discussed. (JFP)

18461 LATERAL DISTRIBUTION FUNCTION FOR MUONS IN SHOWERS AT MOUNTAIN ALTITUDES. Nikol'skii, S. I.; Stamenov, I. N. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1734-1738(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1949-1954(Sep 1970).

The lateral distribution function for muons with energies $E_\mu > 5$ GeV was measured using the Tien-Shan comprehensive EAS facility. The density of the muon component was measured. Also the particle number, shower axis angular coordinates, and the lateral distribution function are discussed. (JFP)

18462 FLUCTUATIONS OF THE NUMBER OF MUONS AND DEPENDENCE OF THE NUMBER OF MUONS ON THE NUMBER OF PARTICLES IN SHOWERS AT MOUNTAIN ALTITUDES. Aseikin, V. S.; Benko, G.; Danilova, T. V.; Kabanova, N. V.; Nikol'skii, S. I.; Stamenov, I. N. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1739-1741(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1955-1957(Sep 1970).

The characteristics of the fluctuation distribution $W(\rho_\mu/N)$ for N = const and the dependence of the density of muons with $E_\mu > 5$ GeV for $r_\mu > r_{const}$ on the number N of particles in the shower were investigated. The angular coordinates θ and φ of the shower axis and its position with respect to the "carpet" of scintillation counters were determined for each individual shower. Using Nishimura-Kamata functions, the total number of particles in the shower was determined from the readings of scintillation detectors at the 20 and 70-meter detection points. The measurement of the charged particle density at a distance of 70 m from the center was duplicated. (JFP)

18463 MONTE-CARLO CALCULATION OF THE FLUCTUATION OF THE NUMBER OF MUONS AT MOUNTAIN ALTITUDES. Danilova, T. V.; Zubova, E. A.; Stamenov, I. N. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1742-1744(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1958-1960(Sep 1970).

Calculations were based on the two-fireball model with isobars. Values of 60, 80, and 90 g/cm^2 were taken for the nucleon interaction length λ_p in air, and 120 g/cm^2 for the pion interaction length. Nucleon interaction points were drawn every 1 g/cm^2, thus avoiding the possibility of several interactions in the same layer. The investigation was restricted to particles with energies above a certain threshold value $E_t = 0.01 \cdot E_0 e^{-x/200}$, where x is the atmospheric depth. Nucleons with energies below this threshold were subsequently disregarded, and the energy of the pions with $E_\pi < E_t$ was added to the energy of the corresponding fireball. (JFP)

18464 FLUCTUATIONS OF THE MUON LATERAL DISTRIBUTION AT MOUNTAIN ALTITUDES. Dedenko, L. G.; Nikol'skii, S. I.; Stamenov, I. N. (Inst. of Physics, Sofia). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1745-1748(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1961-1964(Sep 1970).

In the summer of 1969 the 1000-channel underground hodoscope forming part of the Tien-Shan comprehensive EAS facility was used to obtain the first data on the form of the lateral distribution function for muons with energy $E_\mu > 5$ GeV at an observation point 3300 m above sea level. If the experimental lateral distribution function were approximated by the power law r^{-n}, a least squares solution gives $n = 0.85 \pm 0.15$ for showers with particle number N of between 10^4 and 10^6 at distances from the axis from 10 to 60 m. The results of the calculations and the experimental data are presented. (JFP)

18465 INVESTIGATION OF THE ELECTRON–PHOTON AND MUON COMPONENTS OF EAS AT DIFFERENT DEPTHS. Popova, L. M. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1749-1751(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1965-1967(Sep 1970).

In accordance with the program of the Darm-Lodz group the development of EAS was calculated at different depths with the object of achieving a unified interpretation of the results of different experiments and testing the proposed models. Restriction was made to the investigation of a small number of typical models developed by the Darm-Lodz group for sea level. In investigating the electron-photon component three variants of the so-called CKP model and the so-called isobar model were used. Also the mean separation of muons with different thresholds was calculated at various atmospheric depths. (JFP)

18466 HIGH-ENERGY MUONS IN EXTENSIVE AIR SHOWERS. Vernov, S. N.; Il'ina, N. P.; Khrenov, B. A.; Khristiansen, G. B.; Yarochkina, Z. V. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1752-1756(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1968-1973(Sep 1970).

The results of a study of the muon component of EAS conducted with a wide-gap spark chamber telescope forming part of the Moscow State University comprehensive EAS facility are presented. A brief summary is given of the results obtained so far. Lateral distributions of muons with energy above 10 eV near the axis, estimation of the mean muon energy, nuclear interactions of muons in EAS, and groups of parallel muons with secondary showers are discussed. (JFP)

18467 CALCULATION OF THE ENERGY SPECTRA AND ANGULAR DISTRIBUTIONS OF THE BREMSSTRAHLUNG PHOTONS PRODUCED BY COSMIC-RAY MUONS IN IRON AND LEAD AT SEA LEVEL. Volkova, L. V. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1763-1767(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1982-1986(Sep 1970).

Since the muon energy spectrum can be approximated over quite a broad region by a power function with an effective value of the exponent γ_μ depending on the energy and direction of arrival of the muons, calculations should be made for various values of γ_μ. The photon energy spectrum obtained is also of the exponential type, the exponent γ_p having a somewhat smaller absolute value than γ_μ. The difference $\Delta\gamma = \gamma_\mu - \gamma_p$ is a consequence of the smaller cross sections for bremsstrahlung losses at lower muon energies (incomplete screening). (JFP)

18468 CALCULATION OF THE NUCLEAR CASCADE IN AN EXTENSIVE AIR SHOWER. Fomin, Yu. A.; Khristiansen, G. B. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1711-1713 (Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1924-1926(Sep 1970).

The Monte Carlo method was used to investigate the lateral and energy distributions of the muons and the nuclear-active component of extensive air showers. Also spatial, distributions and energy flux are discussed. (JFP)

18469 REVIEW OF THE EXPERIMENTAL WORK AT LODZ ON EXTENSIVE AIR SHOWERS. Wdowczyk, J.; Gawin, J.; Hibner, J.; Katz, F.; Zujewska, E.; Kendzior, A.; Maze, R.; Tkaczyk, W.; Firkowski, R. (Lodz Inst. of Nuclear Research, Poland). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1650-1655(Sep 1970).

From All-Union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1857-1863(Sep 1970).

This review is devoted to the research on extensive air showers (EAS) being conducted at Lodz. The experimental part of this research is based on observations made using EAS facilities at Lodz and in Paris. (JFP)

18470 ELECTRON–POSITRON ANNIHILATION AND THE STRUCTURE OF HADRONS. Gilman, F. J. (Stanford Univ., CA). pp 29-69 of Theories and Experiments in High-Energy Physics. Kursunoglu, B. (ed.). New York; Plenum Publishing Corp. ([nd]).

A review is given of knowledge of the total cross section for e^+e^- yields hadrons. Particular emphasis is put on scaling and the excitation of new hadronic degrees of freedom. Present information on the psi's is then reviewed in a phenomenological vein, from which one turns to a possible theoretical understanding of the new discoveries in terms of a new hadronic quantum number, a concrete example of which is charm. (JFP)

18471 LOW ENERGY π-MESON PHOTOPRODUCTION FROM PHOTOEMULSION NUCLEI AT A MAXIMUM BREMSSTRAHLUNG ENERGY OF 300 MeV. Lapin, N. I.; Pughachev, G. D. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 9, 1524-1528(Sep 1975). (In Russian).

The analysis was made for the "stars" containing π-mesons with kinetic energies from 0 to 7 MeV. The main contribution to the yield of charged particles from the parent nucleus is shown to result from direct processes. (auth)

18472 MAGNETIC FIELD OF A μ^+ MESON IN A FERROMAGNET. Gurevich, I. I.; Klimov, A. I.; Maiorov, V. N.; Meleshko, E. A.; Nikol'skii, B. A.; Selivanov, V. I.; Suetin, V.A. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 2, 438-451(Aug 1975). (In Russian).

The magnetic fields B_μ at μ^+ mesons in iron, nickel, cobalt and gadolinium are investigated experimentally as depending on the intensity of an external magnetic field H. The field B_μ was measured on basis of the μ^+ meson Larmor precession frequency. The magnitude and direction of the contact magnetic fields B_c of polarized electrons at the μ^+ meson are determined for the indicated ferromagnets on basis of the B_μ(II) dependences measured. Polarization of the electrons is estimated. Induction B_{dom} in the domain of an unsaturated ferromagnet is measured. It is shown that B_{dom} is equal to the saturation induction. (auth)

18473 EFFECT OF MEDIUM ON THE BREMSSTRAHLUNG SPECTRUM OF 40-GeV ELECTRONS. Varfolomeev, A. A.; Glebov, V. I.; Denisov, E. I.; Frolov, A. M.; Khlebnikov, A. S. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 2, 428-438(Aug 1975). (In Russian)

An experiment is described on investigation of the Landau–Pomeranchuk effect with a 40-GeV electron beam of the High Energy Physics Institute accelerator at Serpukhov. Results are presented of measurements of the energy spectra of electrons emitted in the 20 to 80 MeV range from thin radiators (0.05 to 0.15 radiation lengths) of tungsten, lead, aluminium and carbon. In the energy range studied the intensity of bremsstrahlung radiation from heavy substances is appreciably (by 30 to 60%) lower than that from light substances. Comparison with the theoretical spectra shows that suppression of emission from heavy substances is not less than that predicted by the Landau–Pomeranchuk–Migdal theory. (auth)

18474 OSCILLATOR REPRESENTATION IN THE LANDAU PROBLEM OF THE MOTION OF A PARTICLE IN A HOMOGENEOUS FIELD. Granovskii, Ya. I.; Dimashko, Yu. A. (Donetsk State Univ., USSR). Zh. Eksp. Teor. Fiz.; 68: No. 6, 1991-1996(Jun 1975). (In Russian)

A method is proposed for solving the problem of the motion of a particle in a homogeneous electromagnetic field by means of representing dynamic quantities by Bose operators. The usefulness of the method is illustrated by deducing the nonlinear Heisenberg–Euler Lagrangian and the radiative width of the Landau level. (auth)

18475 PROBABILITIES FOR AN ALTERNATIVE EXPLANATION OF THE MOVING MAGNETIC MONOPOLE. Fleischer, R.L. (General Electric Research and Development Center, Schenectady, New York 12301); Walker, R.M. Phys. Rev. Lett. 35: No. 21, 1412-1415 (24 Nov 1975).

The cosmic-ray track that has been interpreted as a magnetic monopole may in principle be from a nucleus that underwent nuclear interactions. The *a priori* probability of this latter process is calculated to be $\sim 10^{-13}$ if the particle moved at the reported velocity of $<0.6c$, but rises to $\sim 10^{-13}$ if $0.7c$ is allowed. Among the number of cosmic rays already examined, the total predicted probabilities for observing such an interacting event would have been $<7\times10^{-13}$ at $<0.6c$ and $\sim 2\%$ at $0.7c$. (auth)

18476 EVIDENCE FOR ANOMALOUS LEPTON PRODUCTION IN e^+e^- ANNIHILATION. Perl, M.L.; Abrams, G.S.; Boyarski, A.M.; Breidenbach, M.; Briggs, D.D.; Bulos, F.; Chinowsky, W.; Dakin, J.T.; Feldman, G.J.; Friedberg, C.E.; Fryberger, D.; Goldhaber, G.; Hanson, G.; Heile, F.B.; Jean-Marie, B.; Kadyk, J.A.; Larsen, R.R.; Litke, A.M.; Lüke, D.; Lulu, B.A.; Lüth, V.; Lyon, D.; Morehouse, C.C.; Paterson, J.M.; Pierre, F.M.; Pun, T.P.; Rapidis, P.A.; Richter, B.; Sadoulet, B.; Schwitters, R.F.; Tanenbaum, W.; Trilling, G.H.; Vannucci, F.; Whitaker, J.S.; Winkelmann, F.C.; Wiss, J.E. (Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720). Phys. Rev. Lett. 35: No. 22, 1489-1492 (1 Dec 1975).

We have found events of the form $e^+ + e^- \to e^\pm + \mu^\mp$ + missing energy, in which no other charged particles or photons are detected. Most of these events are detected at or above a center-of-mass energy of 4 GeV. The missing-energy and missing-momentum spectra require that at least two additional particles be produced in each event. We have no conventional explanation for these events. (auth)

18477 EXPERIMENTAL STUDY OF THE PRODUCTION OF NEUTRAL PIONS IN ANTI pp ANNIHILATIONS AT 1.6 GeV/c. Fett, E.; Haatuft, A.; Olsen, J. M.; (Bergen Univ. (Norway)); Hart, W.; Knight, W. L.; Madrolle, P.; Waldrer, D. (European Organization for Nuclear Research, Geneva (Switzerland)); Alibran, P.; Degrange, B. (LPHNE, Ecole Polytechnique Palaiseau, France); Arnold, R. Phys. Lett., B; 59: No. 2, 182-186(27 Oct 1975).

The heavy liquid bubble chamber Garamelle has been used to study the rate of production of neutral pions in the pionic annihilation of 1.6 GeV/c antiprotons on free protons. Preliminary results are presented on the relative cross sections for most channels together with the mean π^0 multiplicity and the first moments for annihilation into 0 prongs, 2 prongs, 4 prongs, and 6 prongs. (NL)

18478 MEASUREMENTS OF SIGMA ($e^+e^- \rightarrow \mu^+\mu^-$) IN THE ENERGY RANGE 1.2–3.0 GeV. Alles-Borelli, V.; Bernardini, M.; Bollini, D.; Giusti, P.; Massam, T.; Monari, L.; Palmonari, F.; Valenti, G.; Zichichi, A. (European Organization for Nuclear Research, Geneva (Switzerland)). Phys. Lett., B; 59: No. 2, 201-204(27 Oct 1975).

The analysis of 1466 events of the type $e^+e^- \rightarrow \mu^+\mu^-$, in the time-like range from 1.44 to 9.00 GeV^2, shows that the absolute value of the cross section and its energy dependence follow QED expectations within (±3.2%) and (±1.2%), respectively. (NL)

18479 COHERENT π^+ PHOTOPRODUCTION ON ^{3}He IN THE REGION OF THE Δ_{1236} RESONANCE. Bachelier, D.; Bernas, M.; Boyard, J. L.; Jourdain, J. C.; Radvanyi, P. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire). Nucl. Phys. A; 251: No. 3, 433-445(27 Oct 1975).

An experiment study of the ^{3}He(γ,π^+)^{3}H reaction has been performed in the region of the Δ_{1236} resonance between 227 MeV and 453 MeV. The experiment shows two main features: at fixed four-momentum transfer, q^2, the resonance is shifted toward lower energies, this shift increasing with q^2; at a fixed angle, but variable q^2, the minimum of the charge form factor observed in the elastic scattering of electrons on ^{3}He does not appear. Recent calculations explain partly these two effects. This experiment might be used as part of a test of time-reversal invariance in the electromagnetic interaction of hadrons. (NL)

18480 MULTIHADRONIC DECAYS AND PARTIAL WIDTHS OF THE J/ψ(3100) RESONANCE PRODUCED IN e^+e^- ANNIHILATION AT ADONE. Baldini-Celio, R.; Bozzo, M.; Capon, G.; Del Fabbro, R.; Grilli, M.; Iarocci, E.; Locci, M.; Mencuccini, C.; Murtas, G. P.; Spano, M. A. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). Phys. Lett., B; 58: No. 4, 471-474(29 Sep 1975).

The reactions $e^+e^- \rightarrow$ hadrons and $e^+e^- \rightarrow e^+e^-$ have been studied at the J/ψ(3100) resonance. The relative weights of the topological cross sections for fixed charged multiplicity are σ_2 = (32 ± 5)%, σ_4 = (49 ± 8)%, σ_6 = (18 ± 3)%, and σ_8 = (1 ± 0.6)%. The average pion multiplicities are n_{ch} = 3.8 ± 0.3 and n_{π^0} = 3.1 ± 0.8. The decay widths are γ_e = (4.6 ± 0.8) keV, γ_h = (59 ± 24) keV, and γ = (68 ± 26) keV. (NL)

18481 ELECTROPRODUCTION OF NEUTRAL PIONS AT ENERGIES ABOVE THE RESONANCE REGION. Brasse, F. W.; Fehrenbach, W.; Flauger, W.; Gayler, J.; Goel, S. P.; Haidan, R.; Koetz, U.; Korbel, V.; Kreinick, D.; Ludwig, J. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Phys. Lett., B; 58: No. 4, 467-470(29 Sep 1975).

The reaction $ep \rightarrow e'p\pi^0$ has been measured at W = 2.55 GeV and a fixed electron scattering angle of 10.3^0. Two magnetic spectrometers and a lead glass hodoscope were used to detect all four final-state particles. Electroproduction cross sections in the t range −0.15 to −1.4 (GeV/c)^2 at $q^2 = -0.22, -0.55$ and -0.85 (GeV/c)^2 are presented. Above t = 0.6 (GeV/c)^2 the cross sections are considerably smaller than those for photoproduction. (NL)

18482 SEARCH FOR THE η'(958) + γ DECAY OF THE J/ψ(3100) RESONANCE PRODUCED IN e^+e^- ANNIHILATION. Baldini-Celio, R.; Capon, G.; Del Fabbro, R.; Grilli, M.; Iarocci, E.; Locci, M.; Mencuccini, C.; Murtas, G. P.; Spano, M. A.; Spinetti, M. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati). Phys. Lett., B; 58: No. 4, 475-477(29 Sep 1975).

The decay J/ψ(3100) $\rightarrow \eta'$ (958) + γ has been searched for at the Adone e^+e^- storage ring. No candidate event has been found. This allows to set an upper limit of 1.0 keV (90% C.L.) for this decay partial width. (NL)

18483 SEARCH FOR NARROW RESONANCES IN e^+e^- ANNIHILATION INTO HADRONS AT ADONE. Esposito, B.; Felicetti, F.; Peruzzi, I., Piccolo, M.; Ronga, F. (Comitato Nazionale per l'Energia Nucleare, Frascati (Italy). Laboratori Nazionali di Frascati); Marini, A. (Istituto Nazionale di Fisica Nucleare, Sezione di Frascati, Italy); Bartoli, B.; Nigro, M.; Vanoli, F. (Naples Univ. (Italy). Istituto di Fisica); Bisello, D. Phys. Lett., B; 58: No. 4, 478-480(29 Sep 1975).

A search for narrow resonances in the reaction $e^+e^- \rightarrow$ hadrons in the mass regions 1915–2545 MeV and 2970–3090 MeV has been performed at ADONE, the Frascati storage ring. With 90% confidence level our data exclude the production of narrow resonances with integrated cross section larger than 20% of the integrated cross section for production of the J/ψ(3100 MeV). (NL)

18484 SEARCH FOR NARROW RESONANCES IN e^+e^- ANNIHILATION INTO HADRONS IN THE MASS REGIONS 1910–2545 AND 2970–3090 MeV. Bacci, C.; Bidoli, V.; Penso, G.; Stella, B. (Rome Univ. (Italy). Istituto di Fisica); Baldini-Celio, R.; Bozzo, M.; Capon, G.; Del Fabbro, R.; Grilli, M.; Iarocci, E. Phys. Lett., B; 58: No. 4, 481-483(29 Sep 1975).

A search has been made for possible narrow resonances produced in e^+e^- annihilation at Adone, in the mass regions 1910–2545 MeV and 2970–3090 MeV. No evidence has been found for narrow resonances, within the sensitivity of the present work: an upper limit on the energy integrated resonant cross section of about 10% of the J/ψ(3100) corresponding value is deduced. (NL)

18485 AZIMUTHAL DEPENDENCE OF THE DEEP-INELASTIC ELECTRON–PROTON CROSS SECTION. Loveless, R. L. Ithaca, NY; Cornell Univ. (1975). 173p. University Microfilms Order No. 75-27,043.

Thesis (Ph. D.).

The deep-inelastic coincidence reaction e + p yields e + p + X was measured at azimuthal angles of 0 and 180^0 for incident electron energies of 8, 10, and 12 GeV. Any azimuthal asymmetry between 0 and 180^0 would be due to longitudinal-transverse interference. No asymmetry was found to the experimental accuracy of 15 percent. (Diss. Abstr. Int., B)

Weak

Refer also to abstract 19369.

18486 ABSORPTION OF REACTOR ANTINEUTRINOS BY A POLARIZED PROTON TARGET. Kerimov, B. K.; Samsonenko, N. V. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1545-1548(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1738-1741(Aug 1970).

Differential and total cross sections are discussed. (JFP)

18487 DIRECT NEUTRINO PRODUCTION AND CHARMED PARTICLES. Pontekorvo, B. (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 2, 452-456(Aug 1975). (In Russian)

Direct neutrino production, i.e. the production of neutrinos in processes differing from π and K decay, may be observed and studied in high energy neutrino experiments in the absence of the pion and kaon decay region. In contrast to ordinary neutrino beams for which ν_μ are predominant, the neutrinos produced in charmed particle decays are characterized by identical numbers of ν_μ and ν_e. A feature of the experiments suggested is that the background expected is relatively small but the intensity of the effect looked for is also small. The neutrino detector should be capable of recording electron showers produced in interactions between ν_e and nuclei. (auth)

18488 INTERPRETATION OF THE NEW PARTICLE OF THE COSMIC RAY NEUTRINO EXPERIMENT. Rajasekaran, G.; Sarma, K. V. L. (Tata Inst. of Fundamental Research, Bombay). Pramana; 5: No. 2, 78-86(Aug 1975).

In order to reconcile the lifetime of the new particle observed in the cosmic ray neutrino experiment with its production rate, it is proposed that the particle has a new quantum number (κ) which may be assigned to leptons and hadrons. In the production of the new particle, assumed to be a heavy charged lepton, κ is conserved by creating an associated lepton-hadron pair. Suppression of the κ-violating interaction is invoked to interpret the long lifetime of this particle. (auth)

18489 EVIDENCE FOR THE PRODUCTION OF NEW PARTICLES IN COSMIC RAY EXPERIMENTS DEEP UNDERGROUND. Krishnaswamy, M. R. (Tata Inst. of Fundamental Research, Bombay); Menon, M. G. K.; Narasimham, V. S.; Ito, N.; Kawakami, S.; Miyake, S. Pramana; 5: No. 2, 59-77(Aug 1975).

In the cosmic ray experiments deep underground in the Kolar Gold Mines, a special class of events was observed, at present 6 in number, characterized by several, (in general 3), charged particles arising from a vertex, either in air or in the thin material of the detectors, with large opening angles; the vertex is at a distance of around 70 to 100 cms from the rock wall. The most plausible interpretation of these events is that they are due to the decay of new, massive and long-lived particles produced in neutrino collisions inside rock, or through hitherto unknown processes. (auth)

18490 PRODUCTION OF PROMPT MUONS IN THE FORWARD DIRECTION BY 400-GeV PROTON INTERACTIONS. Leipuner, L.B.; Larsen, R.C. (Brookhaven National Laboratory, Upton, New York 11973); Adair, R.K.; Bergey, P.D.; Carter, A.B.; Grannan, D.M.; Kasha, H.; Kellogg, R.G.; Lauterbach, M.J. Phys. Rev. Lett. 35: No. 24, 1613-1616 (15 Dec 1975).

The ratio of prompt negative muons to negative pions produced in the forward direction by the interaction of 400-GeV protons on copper has been determined to be 5.8×10^{-5} for 55-GeV muons, 3.05×10^{-5} for 102-GeV muons, and 1.93×10^{-5} for 230-GeV muons. The ratio of prompt positive muons to negative muons was about 1. (auth)

18491 MUON-PAIR SEPARATION MEASUREMENTS AND COMPARISON WITH TRANSVERSE-MOMENTUM MODELS. Bergeson, H.E.; Elbert, J.W.; Keuffel, J.W.; Larson, M.O.; Lowe, G.H.; Morrison, J.L.; West, W.J. (Physics Department, University of Utah, Salt Lake City, Utah 84112); Mason, G.W. Phys. Rev. Lett. 35: No. 25, 1681-1684 (22 Dec 1975).

Rates of high-energy cosmic-ray muon pairs have been measured for separations up to 70 *m*. Detailed calculations imply that the mean transverse momentum $\langle p_T \rangle$ of mesons with $x > 0.01$ is 0.66 ± 0.10 GeV/*c* at laboratory energies of $\gtrsim 10000$ GeV. We find that the high-p_T muons result mostly from decay of abundantly produced particles with lifetimes $\gtrsim 10^{-8}$ sec, such as pions and kaons. (auth)

18492 DIMUONS PRODUCED BY ANTINEUTRINOS. Benvenuti, A.; Cline, D.; Ford, W.T.; Imlay, R.; Ling, T.Y.; Mann, A.K.; Orr, R.; Reeder, D.D.; Rubbia, C.; Stefanski, R.; Sulak, L.; Wanderer, P. (Department of Physics, Harvard University, Cambridge, Massachusetts 02138). Phys. Rev. Lett. 35: No. 19, 1249-1252 (10 Nov 1975).

In a run with a predominantly $\bar{\nu}$ beam we have observed seven dimuon events which show clearly that dimuons are produced by $\bar{\nu}$ as well as by ν. Using the signature of those events we tentatively identify twelve dimuon events from earlier runs as $\bar{\nu}$-induced. The characteristics of the total sample support the explanation that dimuons arise from new hadron production. (auth)

18493 SEARCH FOR LONG-LIVED PENETRATING NEUTRAL PARTICLES. Benvenuti, A.; Cline, D.; Ford, W.T.; Imlay, R.; Jensen, R.B.; Ling, T.Y.; McIntyre, P.; Mann, A.K.; Orr, R.; Reeder, D.D.; Rich, J.; Rubbia, C.; Stefanski, R.; Sulak, L.; Wanderer, P. (Department of Physics, Harvard University, Cambridge, Massachusetts 02130). Phys. Rev. Lett. 35: No. 22, 1486-1489 (1 Dec 1975).

We report on a search for decays of long-lived penetrating neutral particles in the neutrino beam at Fermilab. We find an event rate consistent with background which corresponds to a fraction $(7 \pm 5) \times 10^{-3}$ of $\nu_\mu(\bar{\nu}_\mu)$ scattering in liquid scintillator. This result poses an apparent contradiction to the observations of Krishnaswamy *et al.* in the Kolar Gold Mines. (auth)

18494 INCLUSIVE HADRON PRODUCTION IN INELASTIC MUON-PROTON SCATTERING AT 150 GeV/c. Loomis, W.A.; Matis, H.S.; Anderson, H.L.; Bharadwaj, V.K.; Booth, N.E.; Fine, R.M.; Francis, W.R.; Gordon, B.A.; Heisterberg, R.H.; Hicks, R.G.; Kirk, T.B.W.; Kirkbride, G.I.; Mo, L.W.; Myrianthopoulos, L.C.; Pipkin, F.M.; Pordes, S.H.; Quirk, T.W.; Shambroom, W.D.; Skuja, A.; Verhey, L.J.; Williams, W.S.C.; Wilson, R.; Wright, S.C. (Enrico Fermi Institute, Chicago, Illinois 60637). Phys. Rev. Lett. 35: No. 22, 1483-1486 (1 Dec 1975).

Inclusive hadron production in muon-proton inelastic scattering has been measured for $q^2 > 0.5$ (GeV/*c*)^2 and $10 < \nu < 135$ GeV. The results are presented in the form of the transverse momentum distribution of charged hadrons and the hadron invariant structure function $F(x)$. Results are given for different regions of q^2 and *s*. (auth)

Strong (Baryon-induced)

Refer also to abstracts 17260, 17263, 18795, and 18856.

18495 MAGNETIC WILSON CHAMBER AS A TOOL FOR THE INVESTIGATION OF NUCLEAR INTERACTIONS. Roinishvili, N. N. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1637-1641(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1844-1848(Sep 1970).

The potential of the magnetic Wilson chamber as a means of investigating multiple particle production processes is evaluated. An attempt is made to find a method that would eliminate the distortion of the particle parameters in the S system. The method consists in substituting for the measured value of the curvature O_m the quantity O_e (the extimator), whose spectrum reproduces the true curvature distribution $w(O_t)$. (JFP)

18496 SOME PROPERTIES OF INELASTIC COLLISIONS AT ENERGIES ABOVE 10^{13} eV. Nikol'skii, S. I. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1642-1649(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1849-1856(Sep 1970).

Concentration is placed on the principal phenomenon that any hypotheses concerning inelastic collisions of nucleons, pions, and nuclei in the energy region 10^{13} to 10^{14} eV should account for: the increase in the fraction of the energy transferred to the electron–photon component, i.e., the drop in the ratio of the energy transferred to charged pions to the energy of the electron–photon cascade, on going from interactions at energies below 10^{13} eV to interactions at energies of $\sim 10^{14}$ eV. (JFP)

18497 RELATION BETWEEN THE LONGITUDINAL AND TRANSVERSE MOMENTA OF PIONS PRODUCED IN NUCLEAR INTERACTIONS WITH $E_0 = 100$ TO 500 GeV. Zelevinskaya, N. G.; Kotel'nikov, K. A.; Maksimenko, V. M.; Slavatinskii, S. A. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1694-1696 (Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1904-1906(Sep 1970).

Scatter plots of the transverse and longitudinal momenta $p_\perp$ and $p_\parallel^*$ in the c.m. system are frequently employed in investigating the strong interactions. The $p_\perp$-$p_\parallel^*$ plot was examined for the π mesons produced in an LiH target by cosmic-ray particles with energies from 100 to 500 GeV (71 interactions recorded at Tien Shan). In the subsequent analysis it was assumed that all the registered events were nucleon-nucleon interactions. The $p_\perp$-$p_\parallel^*$ plot was constructed for all the particles whose momenta were measured (the number of unmeasured particles was less than 10%). The correlation coefficient for the field of points, $R = 0.50 \pm 0.05$, points to an increase in transverse momentum with increase in longitudinal momentum. In order to establish the nature of this increase, one plots the dependence (regression) of the mean transverse momentum $\bar{p}_\perp$ on $p_\parallel^*$. (JFP)

18498 CERTAIN CORRELATIONS IN INELASTIC INTERACTIONS AT ENERGIES ABOVE 200 GeV. Berdzenishvili, O. L.; Gabuniya, L. L.; Garibashvili, D. I.; Gromov, Yu. A.; Kotiyarevskii, D. M.; Mailyan, E. S.; Mandzhavidze, Z. Sh.; Mandzhavidze, I. D.; Mikadze, E. L.; Razdol'skaya, L. A.; Roinishvili, N. N.; Tatalashvili, N. G.; Chikovani, G. E.; Chikovani, L. D.; Chkhaidze, L. V.; Sherrer, E. N. (Inst. of Physics, Tbilisi, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1697-1700 (Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1907-1911(Sep 1970).

An analysis is made of 19 nuclear inelastic interactions of cosmic particles above 200 GeV to study the correlations. It is found that the correlation between the longitudinal and transverse momenta in the S system is not due only to the most energetic particles in the laboratory system; it is attributable to all the particles in the interaction. (JFP)

18499 INVESTIGATION OF pN INTERACTIONS AT 21 GeV USING NUCLEAR EMULSIONS IN A STRONG MAGNETIC FIELD. Azimov, S. A.; Svechnikova, L. N.; Chernova, L. P.; Chernov, G. M. (Inst. of Nuclear Physics, Tashkent). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1700-1704(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1912-1916(Sep 1970).

Certain of the most general characteristics of pN interactions at 20.8 GeV/c were determined by using nuclear emulsions in a strong magnetic field. These properties include angular and momentum distributions, mean number of particles, forward asymmetry, inelasticity coefficients, and energy transfer. (JFP)

18500 ANGULAR CHARACTERISTICS OF HIGH-ENERGY π^-N AND NN INTERACTIONS IN EMULSION. Alekseeva, K. I. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1705-1708(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1917-1921(Sep 1970).

A further analysis was made of jets from high energy π^-N and NN interactions in emulsions produced by cosmic ray particles. The values of the anisotropy parameter and the Lorentz factors of the symmetric system were determined. (JFP)

18501 INVESTIGATION OF THE NEUTRAL COMPONENT OF THE COSMIC RADIATION AT MOUNTAIN ALTITUDES. Babayan, Kh. P.; Boyadzhyan, N. G.; Mamidzhanyan, Z. A. (Erevan Physical Inst.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1709-1710(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1922-1923(Sep 1970).

Results of a study of nuclear interactions at 3200 m above sea level are presented, with events caused by the interactions in the target of single neutral nuclear-active particles striking the apparatus without air accompaniment being selected. The energy of the neutral particle causing the interaction and also the fraction K_{π^0} of the energy of the nucleon produced in the graphite absorber transferred to the π^0 mesons was measured and its distribution discussed. Also the integral energy spectrum for solitary neutrons without air accompaniment was constructed. It can be approximated by a power law with $\gamma = 1.99 \pm 0.10$. (JFP)

18502 SPECTRA OF THE PROTONS FROM THE p + d → p + p + n REACTION FOR PRIMARY PROTON ENERGIES OF 7 AND 10 MeV. Komarov, V. V. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1503-1506(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1691-1694(Aug 1970).

In order to verify the theoretical predictions, an experimental investigation was made of the spectra of the protons from the p + d → p + p + n reaction for two incident proton energies (7 and 10 MeV) and several proton escape angles θ of particular interest. A theoretical analysis of the differential cross section was carried out. (JFP)

18503 REACTION $\bar{p}p \rightarrow \bar{p}p\pi^+\pi^-\pi^0$ AT 5.7 GeV/c AND A $p\omega^0$ ($\bar{p}\omega^0$) ENHANCEMENT AT 1.81 GeV. Atherton, H. W. (CERN, Geneva); Bar-Nir, I.; French, B.; Skura, J.; Boehm, J.; Cvach, J.; Jires, M.; Sedlak, J.; Simak, V.; Zacek, J. Nuovo Cim., A; 30A: No. 3, 505-530(1 Dec 1975).

The final states $\bar{p}p\omega$ and $\Delta^{++}\bar{\Delta}^-\pi^0$, produced in the reaction $\bar{p}p \rightarrow \bar{p}p\pi^+\pi^-\pi^0$ (6435 events) at 5.7GeV/c, are studied. Cross sections are presented, and general features of the resonances produced are investigated. Spin alignment of the ω's, reported earlier, is studied. An enhancement is observed in the ωp ($\omega\bar{p}$) mass plot of mass (1810 ± 15) MeV and width (87 ± 20) MeV. (auth)

18504 K_{l_3}- AND K_{l_4}-FORM FACTORS IN NONLINEAR CHIRAL CALIBRATION SU(3) × SU(3) MODEL. Ilyin, Yu. M.; Sabov, V. I.; Solomon, A. M. (Uzhgorod State Univ., USSR). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 9, 1460-1470(Sep 1975). (In Russian).

K_{l_3}- and K_{l_4}-form factors and the width of K_{l_4}-decay are calculated in the nonlinear chiral SU(3) × SU(3) dynamics in which the breaking of symmetry is introduced in a covariant way. The theoretical predictions for the absolute values of the form factors for K_{l_3}- and K_{l_4}-decays are in good agreement with the experimental data. (auth)

18505 STUDY OF HIGH TRANSVERSE MOMENTUM π^0's AT ISR ENERGIES. Eggert, K.; Giboni, K. L.; Thome, W. (Technische Hochschule Aachen (F. R. Germany). 3. Physikalisches Inst.); Betev, B.; Darriulat, P.; Dittmann, P.; Holder, M.; McDonald, K. T.; Pugh, H. G.; Vesztergombi, G. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 98: No. 1, 49-72(27 Oct 1975).

A study of the transverse momentum spectrum of π^0's produced at c.m. angles $\theta = 90°$ and 53° in pp collisions at $\sqrt{s} = 23.6$, 30.8, 45.1, 53.2, and 62.9 GeV is presented. The experiment was performed with a lead-glass detector. The data can be described with the usual parametrization $p_T^{-n}f(x_T,\theta)$, with $n = 7.2 \pm 0.2$. Comparison between the 90^0 and 53^0 data further indicates no appreciable dependence on θ, at least for $x_T < 0.3$. Two-particle inclusive cross sections for π^0's produced alongside are also presented. They are observed to have a dependence upon the transverse momentum of the dipion similar to that of single-particle cross sections and with the same value of n. Two-photon decays of η mesons are observed between 3 and 4 GeV/c transverse momentum with a production cross section half of that of π^0. (NL)

18506 ANGULAR CORRELATIONS IN PROTON–PROTON COLLISIONS PRODUCING A HIGH TRANSVERSE MOMENTUM π^0. Eggert, K.; Thome, W.; Giboni, K. L. (Technische Hochschule Aachen (F. R. Germany). 3. Physikalisches Inst.); Betev, B.; Darriulat, P.; Dittmann, P.; Holder, M.; Kaltwasser, J.; McDonald, K. T.; Pugh, H. G. Nucl. Phys., B; 98: No. 1, 73-92 (27 Oct 1975).

In an experiment at the CERN ISR, a streamer chamber detector surrounding one of the intersection regions was triggered on large transverse momentum π^0's by means of an array of lead-glass counters. The directions of charged particles and γ-ray converted in lead oxide plates inside the streamer chamber were measured. Data were taken at a c.m. energy of $\sqrt{s}$ = 53 GeV at two production angles of the high-p_T π^0 (90^0 and 53^0). They indicate an enhancement of particles, mostly in the hemisphere opposite to the π^0. (NL)

18507 MEASUREMENT OF THE PROTON–PROTON CROSS SECTION AT THE CERN ISR. Eggert, K.; Frenzel, H.; Giboni, K. L.; Thome, W. (Technische Hochschule Aachen (F. R. Germany). 3. Physikalisches Inst.); Betev, B.; Darriulat, P.; Dittmann, P.; Holder, M.; McDonald, K. T.; Pugh, H. G. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 98: No. 1, 93-99(27 Oct 1975).

A measurement of the total cross section σ_t in proton–proton collisions at the CERN ISR is presented. The method involves determination of the total interaction rate and machine luminosity. A two-arm scintillation hodoscope observes approximately 90% of the total interaction rate, while a streamer chamber is employed for event topologies missed by the main trigger. An increase of about 10% in σ_t is observed in the energy range $\sqrt{s} = 23.6$ to $\sqrt{s} = 62.8$ GeV/c, in agreement with previous experiments. (NL)

18508 OBSERVATION OF STRUCTURE IN ELASTIC pp SCATTERING AT 100 AND 200 GeV/c. Akerlof, C. W.; Kotthaus, R.; Loveless, R. L.; Meyer, D. I. (Michigan Univ., Ann Arbor (USA). Dept. of Physics); Ambats, I.; Meyer, W. T.; Ward, C. E. W. (Argonne National Lab., Ill. (USA)); Earlty, D. P.; Lundy, R. A.; Pruss, S. M. Phys. Lett., B; 59: No. 2, 197-200(27 Oct 1975).

The elastic differential cross section for pp scattering has been measured up to a momentum transfer of abs. value t equals 3 $(GeV/c)^2$ at 100 GeV/c and 200 GeV/c incident momenta. The 200 GeV/c measurements show a diffractive-like dip at abs. value t equals 1.5 GeV/c, while no such dip is seen in the 100 GeV/c data. (NL)

18509 MEASUREMENT OF THE $\bar{p}p$ CHARGE-EXCHANGE CROSS SECTION BELOW 1 GeV/c. Alston-Garnjost, M.; Kenney, R.; Pollard, D.; Ross, R.; Tripp, R. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720); Nicholson, H. Phys. Rev. Lett. 35: No. 25, 1685-1688 (22 Dec 1975).

No definite evidence for structure is found in the $\bar{p}p \rightarrow \bar{n}n$ cross section between 276 and 963 MeV/c. From these results limits are deduced on properties of the narrow enhancement reported in the $\bar{p}p$ total cross section at 475 MeV/c. (auth)

Strong (Meson-induced)

Refer also to abstracts 19064 and 19219.

18510 (LAL-1277) EXPERIMENTAL RESULT ON THE $\pi^0\pi^0$ SYSTEM PRODUCED IN THE $\pi^+p \rightarrow \pi^+p\pi^0\pi^0$ REACTION AT 3.5 GeV/c. Grivaz, J. F. (Ecole Normale Superieure, 91 – Orsay (France). Lab. de l'Accelerateur Lineaire; Paris-11 Univ., 91 – Orsay (France)). Jun 1975. 264p. (In French). INIS.

The reaction $\pi^+p \rightarrow \pi^+p\pi^0\pi^0$ was investigated at 3.5 GeV/c beam momentum, in the CERN 1.2m heavy liquid bubble chamber, filled with a C_3H_8–CF_3B_r mixture. 800 K pictures were analyzed and events with outgoing proton momentum ≤ 800 MeV/c and π^+ momentum ≤ 750 MeV/c were measured. Events with 4 or more γ rays were reconstructed using a kinematic fit procedure. Nuclear background and contamination due to spurious γ's and/or missing true gammas were estimated and subtracted both in magnitude and shape. The following cuts have then been applied: (π^+p) mass greater than 1.12 GeV and smaller than 1.36 GeV and momentum transfer to the (π^+p) system smaller than .3 $(GeV/c)^2$ in absolute value. The $\pi^+\pi^- \rightarrow \pi^0\pi^0$ reaction cross section is then deduced from the remaining sample (125 events) and compared with theoretical predictions. Good agreement is found for ($\pi^0\pi^0$) masses larger than approximately 600 MeV, whereas the behavior of the cross section near threshold suggests a value of the S-wave I-spin 0 scattering length larger than usually expected. (FR)

18511 VARIATION OF TRANSVERSE MOMENTUM IN HADRONIC COLLISIONS. St. Amand, J.; Uritam, R. A. (Boston Coll., Chestnut Hill, MA). Lett. Nuovo Cim.; 14: No. 8, 271-274 (25 Oct 1975).

A successful detailed parametrization of the dependence of the transverse momentum on multiplicity and on beam momentum in high energy hadron–hadron collisions is presented. As input the uncertainty relation and a naive eikonal model with an impact-parameter-dependent multiplicity are used. (JFP)

18512 OBSERVATION ON VECTOR-RESONANCE PRODUCTION IN MULTIPARTICLE PROCESSES. Ingrosso, G.; Rotelli, P. (Univ., Lecce, Italy). Lett. Nuovo Cim.; 14: No. 8, 275-279(25 Oct 1975).

A qualitative analysis is given of an experiment on 205-GeV/c π–p interactions having an average of eight charged particles per event in the final state in order to test the hypothesis that vector resonance production is a preferential mechanism in high energy inelastic processes. Cross sections and distributions are shown. A computer model fit confirms the conclusion that the majority of secondaries (nonleading) originate from the decay of vector resonances. (JFP)

18513 GENERAL CHARACTERISTICS OF PION–NUCLEON INTERACTIONS IN NUCLEAR EMULSION AT ENERGIES OF 45 AND 60 GeV. Anzon, Z. V. (Inst. of Nuclear Physics, Alma-Ata, USSR); Vinitskii, A. Kh.; Voinov, V. G. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1720-1723(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1934-1937(Sep 1970).

The general characteristics of pion-nucleon interactions in nuclear emulsions irradiated in the Serpukhov accelerator are presented. One can give results obtained on a broader statistical basis. The multiplicity, secondary particle angular distribution, and recoil proton momentum spectrum are discussed. (JFP)

18514 COHERENT PARTICLE PRODUCTION BY 45 AND 60 GeV/c π^- MESONS ON EMULSION NUCLEI. Anzon, Z. V. (Inst. of Nuclear Physics, Alma-Ata, USSR), Vinitskii, A. Kh.; Voinov, V. G. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1724-1729(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1938-1943(Sep 1970).

Emulsion data are presented on coherent production of π mesons by π^- mesons at 45 and 60 GeV/c including events found by scanning 512 and 2789 m of track at 45 and 60 GeV/c, respectively. Multiplicity and angular distributions, azimuthal angular distributions of the prong events, and the energy dependence of the coherent interaction path are considered. (JFP)

18515 SOME CHARACTERISTICS OF THE QUASI-NUCLEONIC INTERACTIONS OF 60-GeV π MESONS. Zhdanov, G. B.; Maslennikova, N. V.; Tret'yakova, M. I.; Chernyavskii, M. I. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1730-1733(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1944-1948(Sep 1970).

Five emulsion layers were used irradiated with a 60-GeV/c π^- meson beam in the Serpukhov accelerator. Angular distributions, transverse and charged-particle momenta, two-center emission of produced particles, and the energy release to neutral particles are discussed. (JFP)

18516 (π^+, ^{12}C) ELASTIC AND INELASTIC BACKWARD SCATTERING. Barbini, B. (CNEN, Frascati, Italy); Guaraldo, C.; Scrimaglio, R.; Balestra, F.; Busso, L.; Garfaginini, R.; Piragino, G. Lett. Nuovo Cim.; 13: No. 18, 673-679(30 Aug 1975).

Experimental results of large-angle elastic and inelastic π^+ scattering on carbon-12 at 75 to 95 MeV are reported. The differential cross sections are found and discussed. (JFP)

18517 REACTIONS $K^-p \to \Xi^- K^{0+} \pi^{+0}$ BETWEEN 2210 AND 2435 MeV c.m.s. ENERGY. De Bellefon, A. (College de France, Paris); Berthon, A.; Billoir, P.; Brunet, J. M.; Tristram, G.; Vrana, J.; Baccari, B.; Poulard, G.; Revel, D.; Tallini, B. Nuovo Cim., A; 28A: No. 3, 289-296(1 Aug 1975).

Resonant and production cross sections for the Ξ^*-resonances produced in the reactions $\Xi^- K^+ \pi^0$ and $\Xi^- \pi^+ K^0$ for 7 incident-K^- momenta between 1.93 and 2.52 GeV/c are given. A partial-wave analysis gives evidence for the existence of a resonance in the D5-state in this mass region. (auth)

18518 DIFFRACTIVE DISSOCIATION IN pi- DEUTERIUM INTERACTIONS AT 15 GeV/c. Harris, R. M. Seattle; Univ. of Washington (1975). 314p. University Microfilms Order No. 75-28,357.

Thesis (Ph. D.).

A study was made of three separate diffractive dissociation channels in pi^-d interactions at 15 GeV/c incident momentum. Data were compared for the dissociation of a pion into 3 pi and 5 pi, and the dissociation of a neutron into p pi^-. Low mass diffractive enhancements are seen in all three channels. In the 3 pi d channel, evidence is presented for a third 3 pi enhancement at 1.92 GeV, which is associated with g pi final states. This continues the pattern of p pi and f pi states in the A_1 and A_3 enhancements. Evidence is also presented for an enhancement in the d pi^+pi^- spectrum which may be explainable as an extension of the d* mechanism to N pi pi states. In the 5 pi d channel, a 5 pi enhancement is seen at approximately 2 GeV, but with no significant two body final states. The neutron dissociation channel shows evidence of two separate components in the p pi^- spectrum—a low mass diffractive enhancement at 1.25 GeV, and two N* peaks which appear to be resonances. Comparison with ISR data suggests that the N* resonances are also produced by Pomeron exchange. (Diss. Abstr. Int., B)

18519 ELASTIC SCATTERING OF HADRONS AT 50 TO 200 GeV. Akerlof, C.W.; Kotthaus, R.; Loveless, R.L.; Meyer, D.I. (Physics Department, University of Michigan, Ann Arbor, Michigan 48104); Ambats, I.; Meyer, W.T.; Ward, C.E.W.; Eartly, D.P.; Lundy, R.A.; Pruss, S.M.; Yovanovitch, D.D.; Rust, D.R. Phys. Rev. Lett. 35: No. 21, 1406-1408 (24 Nov 1975).

The differential cross section for π^*, K^*, and p^* on hydrogen have been measured in the range $0.07 < -t < 1.6$ (GeV/c)^2. The dependence on momentum, momentum, transfer, and particle type are discussed. (auth)

18520 STUDY OF DIFFRACTIVELY PRODUCED FIVE-PION FINAL STATES. Harris, R.; Lubatti, H. J.; Moriyasu, K.; Podolsky, W. J. (Washington Univ., Seattle (USA). Dept. of Physics); Bingham, H. H.; Fretter, W. B.; Graves, W. R.; Porter, F. C.; Yost, G. P. (California Univ., Berkeley (USA). Dept. of Physics). Phys. Lett., B; 59: No. 2, 187-190(27 Oct 1975).

Diffractively produced five-pion final states are studied in the reaction pi^-d yields 3 pi^-2pi^+d at 15 GeV/c and compared with predictions of the statistical dissociation model and multiperipheral models. (NL)

18521 STUDY OF Ξ^- AND Ω^- PRODUCTION FROM K-n AND K-p INTERACTIONS AT 4.93 GeV/c. Dibianca, F. A.; Endorf, R. J. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA)). Nucl. Phys., B; 98: No. 1, 137-150(27 Oct 1975).

Cross sections, mass spectra, angular distributions and several other features of Ξ^- and Ω^- production from protons and neutrons in K^-d interactions at 4.93 GeV/c are presented. A five-standard-deviation peak is observed in $\Xi K\pi$ mass spectra near 2.6 GeV/c^2. A sharp rise in the Ξ^- three- and four-body cross sections from K^-n interactions suggests direct-channel $\Sigma^*(3.0-3.5)$ formation. (NL)

18522 Λp MASS ENHANCEMENT IN THE REACTION $K^-d \to \Lambda p\pi^-\pi^0$. Sodhi, A. V.; Goyal, D. P. (Delhi Univ. (India). Dept. of Physics and Astrophysics). Nucl. Phys., B; 97: No. 3, 403-412(20 Oct 1975).

An enhancement in the Λp mass distribution from the analysis of bubble chamber data of the reaction $K^-d \to \Lambda p\pi^-\pi^0$ at K^- momenta of 1.45 and 1.65 GeV/c is reported. The distribution is fitted to a Breit–Wigner resonant structure plus phase space background. The best fit to the data gives the value of the peak at approximately 2115 MeV and the width of the distribution as approximately 150 MeV. A comparison of this result with results obtained by other groups suggests that the enhancement is most likely due to a non-resonant effect. (NL)

18523 K^-p ELASTIC SCATTERING AT 14.3 GeV/c. Drevillon, B.; Borenstein, S.; Chaurand, B.; Gago, J. M.; Salmeron, R. A. (Ecole Polytechnique, 75 – Paris (France). Lab. de Physique des Hautes Energies); Barloutaud, R.; Borg, A.; Spiro, M.; Wohl, C. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires); Paler, K. Nucl. Phys., B; 97: No. 3, 392-402(20 Oct 1975).

Results are presented of a bubble chamber experiment on K^-p elastic scattering at 14.3 GeV/c, in the four-momentum transfer range $0.04 < |t| < 2.74$ GeV^2 for an initial set of 40,000 events. The total eleastic cross section is (2.96 ± 0.10) mb. The results are compared with K^+p elastic scattering data at 13.8 GeV/c, and the effective Regge trajectory is calculated using K^-p data from 5 to 100 GeV/c. (NL)

18524 $K_1^0p \to K_S^0p$ SCATTERING IN THE 1.5–2.3 GeV ENERGY REGION. Alexander, G.; Bar-Nir, I.; Benary, O.; Borowitz, I.; Grunhaus, J.; Lissauer, D.; Oren, Y. (Tel Aviv Univ. (Israel). Dept. of Physics and Astronomy); Burkhardt, E.; Giesecke, J.; Pfeiffer, A. Phys. Lett., B; 58: No. 4, 484-488 (29 Sep 1975).

The $K_1^0p \to K_S^0p$ differential and total cross sections and the forward scattering amplitude phase ϕ have been measured in the 1.5 to 2.3 GeV center-of-mass energy range. The data are compared with predictions based on recent K^+N phase shift solutions. Best agreement is found for K^+N solutions which do not warrant an $I = 0$ $P_{\frac{1}{3}}$ exotic $Z^{0*}(1800)$ baryon. (NL)

18525 INCLUSIVE PRODUCTION OF Y* RESONANCES IN K^-p INTERACTIONS AT 14.3 GeV/c. Bardadin-Otwinowska, M.; Barloutaud, R.; Borg, A.; Louedec, C.; Pierre, F.; Spiro, M. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires); Borenstein, S.; Chaurand, B.; Drevillon, B.; Gago, J. Nucl. Phys., B; 98: No. 3, 418-428(10 Nov 1975).

The inclusive production of $\Sigma^+(1385)$, $\Sigma^-(1385)$, $\Lambda(1405)$, and $\Lambda(1502)$ in K^-p interactions at 14.3 GeV/c is studied. Cross sections are presented and the x dependence of the invariant cross sections is discussed. The density matrices for production of the spin-$\frac{3}{2}$ resonances at small momentum transfer to the target are consistent with spin-0 exchange. (NL)

18526 LAMBDA PRODUCTION IN THE FRAGMENTATION PROCESSES $p + K^- \to \Lambda$ AND $K^- + p \to \Lambda$ AT 4.25 GeV/c. Blokzijl, R.; de Groot, A. J.; Jongejans, B.; Kluyver, J. C.; Massaro, G. G. G.; Wolters, G. F. (Amsterdam Univ. (Netherlands). Zeeman Lab.); Nilsson, S.; Berge, J. P.; Gay, J. B.; Hemingway, R. J. Nucl. Phys., B; 98: No. 3, 401-417(10 Nov 1975).

In the reaction $K^- + p \to \Lambda + X$ at 4.25 GeV/c both the target fragmentation of the proton into lambda and the beam fragmen-

tation of kaon into lambda have been studied. The sample consists of 21000 Λ events with $t > -1.0$ (GeV/c)^2 and 9000 Λ events with $u > -1.0$ (GeV/c)^2. Abundant π^0 and meson resonance production for residual masses $M_X < 1.1$ GeV/c^2 is observed. In the t-channel an effective exchange trajectory is deduced which lies between the K and K(890) trajectories. In the u channel the effective exchange trajectory is in good agreement with a nucleon trajectory. The extrapolated average pion multiplicities of the residual mass system in the u channel are in very good agreement with the values measured in antiproton–proton annihilations at rest. (NL)

18527 ELASTIC SCATTERING OF 10 GeV/c π^+ AND K^+ MESONS AND OF 9 GeV/c PROTONS ON PROTONS. Baglin, C.; Briandet, P.; Fleury, P.; de Rosny, G. (Ecole Polytechnique, 75 – Paris (France)); Carlson, P. J.; Johansson, K. E. (Stockholm Univ. (Sweden)); D'Almagne, B.; Lehmann, P.; Richard, F.; Treille, D. (Paris-11 Univ., 91 – Orsay (France)). Nucl. Phys., B; 98: No. 3, 365-400(10 Nov 1975).

Angular distributions of π^+p and K^+p elastic scattering have been measured for an incident beam momentum of 10.0 GeV/c. For π^+p elastic scattering almost the complete angular distribution was measured. The angular distribution of proton–proton elastic scattering was measured for an incident momentum of 9.0 GeV/c in the interval of the four-momentum transfer squared from 0.7 (GeV/c)^2 to 5.0 (GeV/c)^2. For π^+p elastic scattering the structures at $-t = 2.8$ (GeV/c)^2 and $-t = 4.8$ (GeV/c)^2 are less pronounced than at lower momenta. The cross section for scattering at 90^0 in the c.m. system is of the order of 1 nb/(GeV/c)^2. For K^+p elastic scattering there is a break in the angular distribution around $-t = 3$ (GeV/c)^2. The differential cross sections for proton–proton elastic scattering decrease smoothly with increasing momentum transfers. (NL)

18528 ANTI K*(890) PRODUCTION IN $K^-p \rightarrow NK3\pi$ FINAL STATES AT 10 GeV/c. Graessler, H.; Honecker, R.; Kirk, H. (Technische Hochschule Aachen (F. R. Germany). 3. Physikalisches Inst.); Becker, L.; Karfmann, H. H.; Lohmann, W.; Matthaeus, E.; Schreiber, H. J.; Weigt, G. (Akademie der Wissenschaften der DDR, Berlin-Zeuthen. Inst. fuer Hochenergiephysik); Counihan, M. J. Nucl. Phys., B; 97: No. 3, 365-376(20 Oct 1975).

Results are presented for reactions of the type $K^-p \rightarrow \overline{K}^*(890)N\pi\pi)$ at 10 GeV/c where $\overline{K}^*$ is produced forwards and the nucleon and two pions are all produced backwards in the c.m. Of the three real parts of the $\overline{K}^*$ density matrix elements only one is non-zero while all imaginary parts are consistent with zero. In the non-charge-exchange channel, $K^-p \rightarrow K^{*-}(N\pi\pi)^+$, natural and unnatural spin–parity exchanges are equally important, while in the charge-exchange channels, $K^-p \rightarrow \overline{K}^{*0}(N\pi\pi)^0$, unnatural spin–parity exchanges dominate. These results are compared to those for $K^-p \rightarrow \overline{K}^{*0}(N\pi)$ and found to be very similar for both the charge and non-charge-exchange reactions. However, they are different from those for $K^-p \rightarrow \overline{K}^{*0}N$. (NL)

18529 REACTIONS $K^+n \rightarrow (K\pi\pi)^{+0}N^{0+}$ AT 2 TO 3 GeV/c. Banerjee, S.; Campbell, J. R.; Hall, G.; Islam, A. K. M. A.; May, G.; Miller, D. B.; Orr, R. S. (Imperial Coll. of Science and Technology, London (UK). Dept. of Physics); Allen, J. E.; Morris, S.; O'Brien, K. Nucl. Phys., B; 97: No. 3, 413-425(20 Oct 1975).

The reactions $K^+n \rightarrow K^+\pi^+\pi^-n$, $K^+n \rightarrow K^0\pi^+\pi^-p$, and $K^+n \rightarrow K^+\pi^-\pi^0p$ have been investigated in a 3.8 event/μb K^+d bubble chamber experiment with incident momenta of 2.2, 2.45, and 2.7 GeV/c. Channel cross sections are given, and the general characteristics of the production processes, described. The isobar model is used in an attempt to determine the spin–parity structure of the final states. (NL)

18530 PRODUCTION OF THE ω^0 MESON IN THE REACTION $\pi^+d \rightarrow p_sp\omega^0$ AT 4GeV/c. Emms, M. J.; Kinson, J. B.; Stacey, B. J.; Votruba, M. F.; Woodworth, P. L. (Birmingham Univ. (UK)); Bell, I. G.; Dale, M.; Evans, D.; Major, J. V. (Durham Univ. (UK)); Charlesworth, J. A. Nucl. Phys., B; 98: No. 1, 1-28 (27 Oct 1975).

The reaction $\pi^+n \rightarrow \omega^0p$ has been studied at 4 GeV/c and yielded a total cross section of 313 ± 26 μb. The sample of about 3500 ω^0 events produced in the forward direction has been used to determine the differential cross section and the spin density matrix elements. The effective trajectory for unnatural parity exchange has been determined by a comparison of $\rho_{00}d\sigma/dt$ at different energies. A comparison of $\rho_{00}d\sigma/dt$ has been made with the similar data for ρ^0 production in this experiment; this allowed π–B exchange degeneracy and $\rho-\omega$ interference to be investigated. These methods result in an unnatural trajectory consistent with that expected for the B meson. A further study of $\rho-\omega$ interference has been made by comparing the reactions $\pi^+n \rightarrow \omega^0p$ and $\pi^-p \rightarrow \omega^0n$ at similar energies. The results on ω and ρ production are combined with data on K^{*0} and $\overline{K}^{*0}$ production at 4 GeV/c, and an SU(3) sum rule relating the production of these four mesons is shown to be satisfied. (NL)

18531 HIGHER STATISTICS INVESTIGATION OF K/sub s/^{0}K$^-$ DECAY OF THE A_2^- PRODUCED BY 23-GeV/c pi$^-$ ON HYDROGEN. Margulies, M. New York; City Univ. of New York (1975). 170p. University Microfilms Order No. 75-18,713.

Thesis (Ph. D.).

Using the BNL Mkl Spectrometer, 3346 new events of the type pi$^-$p yields K^0/sub s/K^- + p in the effective mass range M(K^0/sub s/K^-) equals 1.1 to 1.5 GeV were obtained and analyzed. The K^0/sub s/K^- effective mass spectrum shows a single peak in the A_2 mass region which is well fitted by a D-wave Breit–Wigner shape. The data in the A_2 peak region agree with previous results and rule out conclusively (greater than 7.9 standard deviations) the split A_2 shape reported earlier by other investigators. The background level is approximately 10 to 20 percent. Total and differential cross section measurements were made at 22.4 and 23.9 GeV/c. The parameterization d sigma/dt' alpha - t'e/sup bt'/ describes the differential cross section data with the parameter b equals 7.0 +- .2 (GeV/c)$^{-2}$. The momentum dependence of the cross sections for the reaction was obtained using this data and the data from other experiments. The A_2 decay angular distribution was measured in the Gottfried–Jackson frame for the K^0K^- decay mode of the A_2^-. The angular distribution may be explained by a dominant exchange of natural spin parity vector mesons (i.e., rho^0 and f^0) in the production process. The A_2 angular distributions are consistent with those of a single resonance with a J/sup P/ equals 2^+. (Diss. Abstr. Int., B)

18532 TEST OF THE DELTA S equals DELTA Q RULE IN K_{e3} DECAY. Smith, J. G. San Diego, CA; Univ. of California (1975). 110p. University Microfilms Order No. 75-29,462.

Thesis (Ph. D.).

The time distribution of the pi/sup -+/ e/sup +-/ nu. decays from an initially pure K^0 beam were studied using data taken in a spark chamber experiment at the Lawrence Berkeley Laboratory Bevatron. The production reaction pi$^-$ p yields LAMBDA^0 K^0 was used for 1.06 GeV/c negative pions incident on a CH_2 target. The decay particles from both the kaon and the lambda were observed and momentum analyzed. A large Cherenkov counter filled with isobutane gas detected the electron or positron. The final sample of 79 events in the decay time interval 0.6 tau/sub K/sub s/ lt t lt 5.0 tau/sub K/sub s/ produced the results Re x equals $0.10^{+0.18}_{-0.19}$, Im x equals $-0.10^{+0.16}_{-0.18}$, consistent with no violation of the DELTA S equals DELTA Q rule. If CP conservation in the decays was also assumed, Re x equals $0.03^{+0.16}_{-0.17}$ was found. (Diss. Abstr. Int., B)

Particle Interactions and Properties (Theoretical)

18533 COMPONENTS OF νW_2 AND SU-6w BREAKING IN DEEP INELASTIC SCATTERING. Flume-Gorczyca, B.; Kitakado, S. (Deutsches Elektronen-Synchrotron, Hamburg). Nuovo Cim., A; 28A: No. 3, 321-336(1 Aug 1975).

Two independent components of the nondiffractive part of the structure functions are isolated, using the data from deep inelastic eN scattering and some preliminary results from neutrino experiments. This enables us to solve the problem of the apparent nonscaling of the Δ-resonance in the Bloom-Gilman sense and to estimate D/F for the reggeon coupling to baryons in hadronic reactions. (auth)

General

Refer also to abstracts 19335 and 19353.

18534 (CNRS-RA-1973) PROGRESS REPORT OF SCIENTIFIC BRANCHES – 1973. (Centre National de la Recherche Scientifique, 75 – Paris (France)). 1974. 227p. (In French). INIS.

Research work carried out in the various fields is presented: nuclear physics, particle physics, atomic and molecular physics, plasmas, etc. (FR)

18535 (COO-2009-114) RESEARCH ACCOMPLISHMENTS OF THE INDIANA UNIVERSITY THEORETICAL PARTICLE PHYSICS PROGRAM. Chu, S. Y.; Hendry, A. W.; Lichtenberg, D. B. (Indiana Univ., Bloomington (USA). Dept. of Physics). 1975. Contract E(11-1)-2009. 9p. Dep. NTIS $3.50.

The significance of theoretical research in elementary particle physics is briefly described in terms the educated layman can understand. (auth)

18536 (IN-2P3-EC-74(Vol. 1), pp 271-295) RECENT PROGRESS IN GAUGE THEORY. Iliopoulos, J. [nd]. (In French)
From summer school on particle physics; Gif-sur-Yvette, France (9 Sep 1974).
Distributed by M. M. S. Detoeuf, IN2P3, 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05.
In summer school on particle physics. Gif-sur-Yvette, 9-21 September 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).
Emphasis is laid on recent developments such as asymptotic freedom, research on charm and color and speculations on the general unification of all interactions. An attempt was made to combine the experimental results of all processes involving currents, both at low energy and in the scaling region, and a coherent system can be obtained by postulating that gauge theories describe all interactions between elementary particles. (FR)

18537 (MPI-PAE-EXP.EL-41) STUDY OF CORRELATION EFFECTS IN HIGH-MULTIPLICITY PROTON-PROTON REACTIONS AT 12 AND 24 GeV/c. Blobel, V.; Fesefeldt, H.; Hellwig, B.; Moenkemeyer, D.; Freund, P.; Lamsa, J. W.; Lueers, D.; Schmitz, N.; Schwarzschild, B. M.; Geich-Gimbel, C. (Max-Planck-Institut fuer Physik und Astrophysik, Muenchen (F. R. Germany)). Nov 1974. 40p. INIS.
Available from ZAED.
Correlations in multiparticle final states from pp interactions at 12 and 24 GeV/c are studied. In an attempt to distinguish true dynamical correlations from the consequences of kinematics together with P_T damping and the leading-particle effect, the data are compared with an independent-emission model which reproduces the single-particle spectra and also with a model that simulates a fragmentation mechanism. The forward-backward particle configuration is investigated and in particular the multiplicity imbalance and charge transfer, defining forward-backward by the largest rapidity gap as well as simply by cms hemispheres. Clustering is also studied by looking at distributions of the dispersions in longitudinal rapidity. From the comparison of the data with the models clear evidence is found for dynamical correlations of a sort one would expect from fragmentation-type mechanisms. Indications of non-fragmentation formation of neutral meson clusters are also found. (DE)

18538 QUARKS, MAGNETIC MONOPOLES, AND NEGATIVE MASS. Winterberg, F. (Univ. of Nevada, Reno). Lett. Nuovo Cim.; 13: No. 18, 697-703(30 Aug 1975).
The principle of equivalence automatically requires that the inertial mass of the magnetic monopoles must be also negative. Therefore, the hypothesis is suggested that the dually charged particles by Schwinger have a negative inertial mass. Quark properties are considered in the light of this hypothesis. (JFP)

18539 VARIATIONAL TREATMENT OF PARTICLE-REDISTRIBUTION REACTIONS. Efimenko, T. G.; Zakhar'ev, B. N.; Lkhagva, O. (Joint Inst. for Nuclear Research, Dubna, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1598-1601(Aug 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1798-1801(Aug 1970).
The use of Kohn's principle is used in describing reactions involving particle redistribution as well as processes with participation of three or more free fragments before or after the reaction, e.g., A + B → a + b + c. Stationary functionals for the scattering amplitudes, reactions with particle redistribution, reactions with more than two free particles in the initial or final state, and cross sections are considered. (JFP)

18540 MULTIPERIPHERAL THEORIES OF INTERACTION AT HIGH ENERGIES. Dremin, I. M. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1623-1629(Sep 1970).
From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1829-1835(Sep 1970).
A brief account is given of the theory's development, its present state, and the principal problems still outstanding. The interrelation of one-pion and Regge theories is noted. (JFP)

18541 WESS–ZUMINO SUPERALGEBRAS AND O'RAIFERTAIGH'S THEOREMS. Mecklenbug, W. (Univ., Vienna). Lett. Nuovo Cim.; 13: No. 18, 683-686(30 Aug 1975).
The superalgebras proposed previously and considered in the light of O'Raifeartaigh's theorems are considered. It is shown where the Wess–Zumino scheme fits into the O'Raifeartaigh classification of Lie algebras. Using previous results, the utility of considering generalized Lie algebras rather than ordinary ones is discussed. Finally, the proof of O'Raifeartaigh mass splitting theorem is extended to generalized Lie algebras. (JFP)

18542 MODELS OF RELATIVISTIC HAMILTONIAN INTERACTIONS. Arens, R. (Univ. of California, Los Angeles). Int. J. Theor. Phys.; 13: No. 4, 227-236(Jul 1975).
A model of a relativistically invariant Hamiltonian 2-particle interaction is given. It is classical in the sense of having 6 degrees of freedom. This model shows that the earlier general definition of such systems is not vacuous. In this model the forces of interaction die away as the particles are removed from each other. (auth)

18543 SIX BITS FOR NINE COLORED QUARKS. Edmonds, J. D. Jr. (San Diego State Univ., CA). Int. J. Theor. Phys.; 13: No. 4, 259-263(Jul 1975).
The hypercomplex number system of the Dirac equation is used to generalize SU(2) to the covering group of SO(4). The basic representations in this number language suggest a parton model of 6 "bits" and 6 "antibits"; one with spin 0, two with spin ½, and three with spin 1. The relation of this to the special relativity group is also considered. (auth)

18544 PARITY NONCONSERVATION IN TWO-ELECTRON ATOMS AND IONS. Gorshkov, V. G.; Labzovskii, L. N. (Leningrad Inst. of Nuclear Physics). Zh. Eksp. Teor. Fiz.; 69: No. 4, 1141-1147(Oct 1975). (In Russian)
Parity nonconservation effects arising in the presence of neutral weak currents are considered. It is shown that for the ion of the carbon isotope $C^{13}V$ the degree of asymmetry of photon emission with respect to direction of the magnetic field H reaches unity at $H \sim 10^6$ gauss. In weak magnetic fields the degree of asymmetry of photon emission and the degree of circular polarization are of the order of 10^{-4} for He atoms and $C^{13}V$ and Cu^{28} ions. (auth)

18545 UNIFIED APPROACH TO MULTIPARTICLE PRODUCTION AT HIGH ENERGY. Carruthers, P. (Los Alamos Scientific Lab., NM); Zachariasen, F. pp 349-370 of Theories and Experiments in High-Energy Physics. Kursunoglu, B. (ed.). New York; Plenum Publishing Corp. ([nd]).
Some pertinent definitions in the nonrelativistic case are reviewed, and it is shown how one may treat the scattering of single particle from a potential well using the transport equation method. The problem of particle production in relativistic field theory is illustrated for scalar field theories involving a c-number potential and for a PHI^4 self-interaction. The qualitative ideas of this new method are summarized. The formulation of covariant transport theory is treated. (JFP)

18546 WHAT IS THE MEAN TRANSVERSE MOMENTUM OF PROTONS EQUAL TO: $q_t > 1$ GeV/c. Levin, E. M.; Ryskin, M. G. (Leningrad Inst. of Nuclear Physics). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1537-1549(Nov 1975). (In Russian)
Various experiments are considered which may be employed to estimate the mean transverse parton momentum (q_t). They all yield $(q_t) > 1$ GeV/c. An analysis of transformation processes of partons into hadrons shows that the large value of the parton transverse momentum is not inconsistent with the low value of the mean transverse momentum of pions (≈0.4 GeV/c) produced in hadron collisions. The large value of (q_t) can be applied to substantiate the validity of the additive quark model at high energies and to predict a number of properties of fundamentally inelastic processes which may be checked experimentally. (auth)

18547 QUASICLASSICAL APPROXIMATION FOR THE DIRAC EQUATION. Polikanov, V. S. (Leningrad Inst. of Nuclear Physics). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1501-1506(Nov 1975). (In Russian)
Quasiclassical expressions for the energies and phases of a Dirac particle in a static centrally-symmetric field are obtained. Formulas for the cross sections for scattering into small and large angles are also derived. (auth)

18548 INTERFERENCE OF TWO-PARTICLE PHYSICS AND IN ASTRONOMY. Kopylov, G. I.; Podgoretskii, M. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 2, 414-421(Aug 1975). (In Russian)
Two types of experiments for observing interference of two-particle states of identical particles are compared, viz. space-time and momentum-energy experiments. Both of them can be employed for measuring the size of the particle source. A gedanken experiment is proposed which should permit one to follow the transition of these mutually exclusive types of experiments into each other. (auth)

18549 EVIDENCE FOR JET STRUCTURE IN HADRON PRODUCTION BY e^+e^- ANNIHILATION. Hanson, G.; Abrams, G.S.; Boyarski, A.M.; Breidenbach, M.; Bulos, F.; Chinowsky, W.; Feldman, G.J.; Friedberg, C.E.; Fryberger, D.; Goldhaber, G.; Hartill, D.L.; Jean-Marie, B.; Kadyk, J.A.; Larsen, R.R.; Litke, A.M.; Lüke, D.; Lulu, B.A.; Lüth, V.; Lynch, H.L.; Morehouse, C.C.; Paterson, J.M.;

Perl, M.L.; Pierre, F.M.; Pun, T.P.; Rapidis, P.A.; Richter, B.; Sadoulet, B.; Schwitters, R.F.; Tanenbaum, W.; Trilling, G.H.; Vannucci, F.; Whitaker, J.S.; Winkelmann, F.C.; Wiss, J.E. (Lawrence Berkeley Laboratory and Department of Physics, University of California, Berkeley, California 94720). Phys. Rev. Lett. 35: No. 24, 1609-1612 (15 Dec 1975).

We have found evidence for jet structure in e^+e^-→hadrons at center-of-mass energies of 6.2 and 7.4 GeV. At 7.4 GeV the jet-axis angular distribution integrated over azimuthal angle was determined to be proportional to $1+(0.78\pm0.12)\cos^2\theta$. (auth)

18550 NEW GAUGE MODEL OF LIGHT AND HEAVY QUARKS. Clavelli, L.; Raychaudhuri, A. (Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). Phys. Rev. Lett. 35: No. 24, 1607-1609 (15 Dec 1975).

A new anomaly-free gauge model based on an SU(2) ⊗SU(2) ⊗U(1) group is proposed with 32 quarks and leptons. The model permits a dominantly $I=0$ neutral current, predicts $R\simeq 6\frac{1}{3}$, explains the $\Delta I=1/2$ rule, and allows the charmed quark to decay predominantly to nonstrange particles. (auth)

18551 A TEMPORARY ORGANIZATION OF THE SUBATOMIC PARTICLES. Swartz, C.E. Phys. Teacher 13: No. 9, 542-544 (Dec 1975).

A summary is presented of the elementary particles and how they are currently classified on the basis of their intrinsic properties. (AIP)

18552 EIGHT-QUARK MODEL OF WEAK INTERACTIONS WITH LEFT-HANDED CURRENTS. Suzuki, M. (Department of Physics and Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720). Phys. Rev. Lett. 35: No. 23, 1553-1556 (8 Dec 1975).

A gauge model is proposed which contains only left-handed currents of quarks and leptons. The nuclear β-decay current couples to the intermediate boson with partial strength of the gauge coupling, and a new mixing angle is introduced to ensure the universality of the β decay and the μ decay. (auth)

18553 p STATES OF CHARMONIUM AND THE FORCES THAT CONFINE QUARKS. Schnitzer, H.J. (Department of Physics, Brandeis University, Waltham, Massachusetts 02154). Phys. Rev. Lett. 35: No. 22, 1540-1543 (1 Dec 1975).

A measurement of the energy differences of the $n=2$, ^3P_J states of charmonium may give significant information on the dynamics of the spin-dependent quark-antiquark ($q\bar{q}$) forces, since the more rapidly these forces increase with $q\bar{q}$ separation, the larger the ratios $R_1=[E(^3P_2)-E(^3P_1)]/[E(^3P_1)-E(^3P_0)]$ and $R_2=[E(^3P_1)-E(^1P_1)]/[E(^3P_1)-E(^3P_0)]$ become if the forces are of vector character. (auth)

18554 RELATIVISTIC CALCULATION OF RADIATIVE $M1$ TRANSITIONS IN CHARMONIUM. Feinberg, G. (Department of Physics, Columbia University, New York, New York 10027); Sucher, J. Phys. Rev. Lett. 35: No. 25, 1740-1743 (22 Dec 1975).

The transition rate for various radiative $M1$ decays between charmonium S states are calculated relativistically. The rates depend considerably on the quark mass and on the Dirac covariants in the potential. The $M1$ decays may therefore be a sensitive probe of quark interactions. Some numerical results are presented for a linear potential. (auth)

18555 COMMENT ON THE OBSERVATION OF A MOVING MAGNETIC MONOPOLE. Hungerford, E.V. (Physics Department, University of Houston, Houston, Texas 77004). Phys. Rev. Lett. 35: No. 19, 1303-1305 (10 Nov 1975).

It is determined that if the recent observation of a cosmic-ray track is accepted as produced by a magnetic monopole then the magnetic charge must correspond to a south-seeking pole for a monopole mass less than 6.6×10^3 GeV/c^2. In addition, the pole could not have been produced by a primary cosmic ray in the upper atmosphere. (auth)

18556 COMMENT ON VACUUM POLARIZATION AND THE ABSENCE OF FREE QUARKS IN FOUR DIMENSIONS. Gasiorowicz, S. (School of Physics and Astronomy, University of Minnesota, Minneapolis, Minnesota 55455). Phys. Rev. D 12: No. 8, 2526-2527 (15 Oct 1975).

An Abelian model of electric flux line confinement due to Kogut and Susskind is examined, and certain novel features are pointed out. The nonlinear differential equations are studied by means of the *phase-plane method*, which shows that the size of the confining tube cannot be determined by the linear approximation. (auth)

18557 FACTORIZATION OF THE SIX-PARTICLE MULTI-REGGE AMPLITUDE. Moen, I.O. (Physics Department, McGill University, Montreal, Canada). Phys. Rev. D 12: No. 8, 2486-2495 (15 Oct 1975).

It is shown that factorization of the multi-Regge contribution to the six-particle amplitude follows from the complex-helicity-plane structure, the Steinmann relations, and extended unitarity. The six-particle multi-Regge amplitude also satisfies some new discontinuity relations which are interpreted as resulting from the interplay of singularities required by the Gram-determinant constraint in four-dimensional space-time. (auth)

18558 REGGE CUTS IN INCLUSIVE REACTIONS. Paige, F.E.; Trueman, T.L. (Brookhaven National Laboratory, Upton, New York 11973). Phys. Rev. D 12: No. 8, 2422-2442 (15 Oct 1975).

The contribution of Regge cuts to single-particle inclusive processes is analyzed using the techniques of Gribov. The dependence of these contributions on the polarization state of the target is emphasized. A general formula is obtained and certain contributions to it are calculated. It is not possible, however, to reduce this to a simple, powerful formula expressing the total cut contribution in terms of other measurable quantities, as can be done for the cut contribution to the total cross section. The reasons for this are discussed in detail. The single-particle intermediate states, analogous to the absorption model for elastic scattering, are explicitly calculated as an illustration. (auth)

18559 TRIPLE-REGGE REGION AT SUBASYMPTOTIC ENERGIES IN REGGEON FIELD THEORY. Frazer, W.R.; Moshe, M. (Department of Physics, University of California, San Diego, La Jolla, California 92037). Phys. Rev. D 12: No. 8, 2385-2389 (15 Oct 1975).

We derive asymptotic results for the inclusive cross section in the triple-Regge region. The approach to this limit which will be detected at subasymptotic energies is especially emphasized. We discuss also the relation of the asymptotic inclusive cross section to the low-energy perturbation scheme. (auth)

Electromagnetic

Refer also to abstracts 18470, 18550, 18636, 18686, 18708, 18788, 19367, and 19368.

18560 (IN-2P3-EC-74(Vol.2), pp 3-63) PHOTON AND PHOTON REACTIONS: ELEMENTARY THEORETICAL INTRODUCTION. Diu, B. [nd]. (In French).

From summer school on particle physics; Gif-sur-Yvette, France (9 Sep 1974).

Distributed by M. S. Detoeuf, IN2P3 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05.

In summer school on particle physics, Gif-sur-Yvette, 9-21 September 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

The electromagnetic field and associated quanta, the photons, are simply and briefly studied. The conventional electromagnetism laws are recalled. Fundamental concepts such as gauge invariance, the electromagnetic current conservation, and photon behavior against the internal symmetries of strong interactions are simply introduced. Results and notations are applied to analysis of reactions where photons intervene in initial or final states (photoproduction) within the limits of amplitude properties in the conventional space-time. The helicity and invariant amplitude formalisms are compared. (FR)

18561 DEVELOPMENT OF ELECTRON–PHOTON SHOWERS. Ivanenko, I. P. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1667-1676(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1875-1884(Sep 1970).

Progress made in the theory of electron-photon shower development is reviewed, and the results of calculations are compared with experiment, considering only those aspects of the theory that are currently in process of rapid development or essential to the further development of the theory as a whole. (JFP)

18562 MONTE CARLO CALCULATIONS OF THE NUCLEAR CASCADE PROCESS IN A HEAVY ABSORBER. Akimov, V. N.; Matachun, A. T.; Slavatinskii, S. A.; Fetisov, I. N. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1680-1688(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1888-1892(Sep 1970).

In previous calculations of the nuclear-cascade process in heavy material only the average characteristics of the cascade were obtained. It has now become necessary to calculate the nuclear-cascade process with allowance for the fluctuations of the most important parameters of the elementary event. A detailed program for such calculations via the Monte Carlo method was compiled taking the parameters of the elementary interactions from accelerator and cosmic-ray data. The calculations were performed for primary nucleons and pions. It was assumed that in the inelastic interactions of nucleons and pions with atomic nuclei, pions are produced and heavily ionizing nuclear-disintegration products (h particles) are formed. (JFP)

18563 KINEMATIC INTERPRETATION OF ASYMMETRIC SHOWERS. Murzin, V. S.; Saryeheva, L. I. (Moscow State

Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1689-1693 (Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1893-1903(Sep 1970).

The distinctly different properties of the two kinds of showers mean that they cannot be described by a single model. In what follows certain relatively simple kinematic models are proposed as a possible basis for the interpretation of these interesting effects. (JFP)

18564 STRUCTURE OF THE LATERAL AND ANGULAR DISTRIBUTIONS OF THE SHOWER PARTICLES NEAR THE AXIS OF AN ELECTRON–PROTON SHOWER. Guzhavin, V. V.; Ivanenko, I. P. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1782-1786(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 2003-2007(Sep 1970).

The dependence of the limiting radius of applicability of the core approximation on the threshold energy is considered in more detail. The dependence on the angular distribution of shower electons and on the threshold energy is considered. It is found that the core approximation holds within 10 to 20% for angles less than 3° and energy greater than 10^8 eV and that the accuracy drops rapidly as the energy increases. (JFP)

18565 RANGE IN EARTH OF ULTRAHIGH-ENERGY ELECTRONS (CASCADE THEORY IN THE ULTRA-RELATIVISTIC REGION). Pomanskii, A. A. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1787-1790 (Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 2008-2012(Sep 1970).

The total range of an electron–photon shower in matter actually the transport range of electrons or photons is directly related only to the probability per t unit for an electromagnetic process and increases with increase in energy according to the same law as governs the decrease of this probability. It is found that the range in earth of electrons and photons with energies of some 10^{19} to 10^{20} eV should be comparable with the ranges characteristic of cosmic-ray muons. (JFP)

18566 TRANSITION EFFECT WITH ALLOWANCE FOR POLARIZATION OF THE MEDIUM. Gerasimova, N. M.; Shteingradt, D. M. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1791-1792(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 2013-2014(Sep 1970).

The variation of the transition effect with allowance for polarization of the medium is investigated. Bremsstrahlung and pair production cross sections valid for complete screening are employed. The sign of the effect and the estimation of the actual change in the magnitude of the transition effect as a result of taking the polarization of the medium into account are discussed. (JFP)

18567 APPROXIMATE METHOD OF CALCULATING THE TRANSITION EFFECT. Emel'yanov, Yu. A.; Lukin, Yu. T.; Sadykov, T. Kh. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1793-1796(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 2015-2018(Sep 1970).

On the basis of the method described, the transition effect was calculated at shower maximum for various thicknesses of the copper transition layer. Using the same method the transition coefficients at various depths in lead were calculated for primary particle energies of 0.4 and 1.0 GeV. (JFP)

18568 PERTURBATION METHOD IN TRANSITION EFFECT THEORY. Kol'chuzhkin, A. M.; Ryzhov, V. V.; Uchaikin, V. V. (Tomsk Polytechnic Inst., USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1797-1801(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 2019-2023(Sep 1970).

It is proposed to analyze the transition effect by means of perturbation theory, expressing the magnitude of the effect in terms of the angular and energy differentials of the shower particle flux in a homogeneous medium. This method is a generalization of earlier results. Transition curve calculations at 100 to 1000 MeV showed that this effect does not depend on the initial electron energy; this is consistent with the results of previous work. (JFP)

18569 ELECTROMAGNETIC MECHANISM OF DIRECT MUON AND PHOTON PRODUCTION. Feinberg, E. L. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1768-1775(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1987-1994(Sep 1970).

The production of muons by the fluctuation mechanism, by an electromagnetic mechanism that is known to operate but may prove quantitatively inadequate, is considered. It is found that when photon–pion equilibrium is taken into account, it is difficult to reconcile the obtained figure of 0.02 for the ratio of directly produced to decay muons with the photon data. Either this ratio is smaller than 0.02 or the direct-production mechanism is different. (JFP)

18570 PHOTOPRODUCTION OF AN ELECTRON–POSITRON PAIR AND SEVERAL PHOTONS IN THE FIELD OF A NUCLEUS. Nadzhafov, I. M. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1593-1597(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1793-1797(Aug 1970).

The e^-e^+ production $j = 1$, 2, and 3 is considered with allowance for longitudinal polarization of the electron and positron together with circular polarization of the photons. Some new results are presented on the energy spectra, differential cross sections, and polarization. (JFP)

18571 OFF-DIAGONAL EXTENDED VECTOR DOMINANCE AT $q^2 = 0$. Dominguez, C. A. (Instituto Politecnico Nacional, Mexico City). Lett. Nuovo Cim.; 13: No. 18, 704-708(30 Aug 1975).

It is shown that from the data at $q^2 = 0$ on $\sigma_T(\gamma p)$, $(d\sigma/dt)(\gamma p \to \rho p)|_{k=0}$ and $(d\sigma/dt)(\gamma p \to \rho'' p)|_{k=0}$ one is left with extremely few choices of models for the off-diagonal contributions at $q^2 = 0$. In other words, it is shown that experiments at $q^2 = 0$ impose very severe constraints and in this way force the conclusion that whatever might be the model in the spacelike region, it has to reduce to quite a few particular forms at $q^2 = 0$. (JFP)

18572 ELECTROMAGNETIC INTERACTIONS AND FIELD THEORY. Proceedings of the XIV International Conference, Schladming, Austria, February 24–March 7, 1975. Urban, P. (ed.). Acta Physica Austriaca, Supplementum XIV. Vienna; Springer-Verlag (1975). 681p. (CONF-750244-). $63.70.

Abstracts were prepared for the 14 papers presented. (JFP)

For abstracts of individual papers see: 18420, 18457, 18573–18576, 18625, and 19310–19316.

18573 PHOTON–HADRON INTERACTION IN THE RESONANCE REGION. Rollnik, H. (Univ., Bonn). Acta Phys. Austriaca, Suppl.; 14: 5-87(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear phsyics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

Lectures are given describing the progress of the understanding of the photon–hadron interaction in the resonance region. The fundamental properties of the electromagnetic hadron current and its behavior under symmetries and a detailed description of photon couplings of hadronic states are discussed. Processes where real photons interact with nucleons are mainly considered. The light-like electric dipole operator, a test of general symmetry properties of the hadronic current, the electromagnetic couplings of the $\Delta(1236)$ isobar, multipole analyses for higher excited nucleon states, and a symmetry approach to the photon-baryon couplings are covered. (JFP)

18574 TWO-BODY AND QUASI-TWO-BODY ELECTRO- AND PHOTOPRODUCTION AT HIGH ENERGIES. Bartl, A. (Univ., Vienna). Acta Phys. Austriaca, Suppl.; 14: 89-142(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

The discussion of two-body and quasi-two-body electro- and photoproduction above the resonance region, $s > 5(\mathrm{GeV}/c)^2$, includes two simple models for charged pion production, the kinematics of single pion electroproduction, Regge models for pseudoscalar meson production, modified Born term models, and photo- and electroproduction of neutral vector mesons. (JFP)

18575 e^+e^- ANNIHILATION, THE NEW PARTICLES, AND CHARM. Ellis, J. (CERN, Geneva). Acta Phys. Austriaca, Suppl.; 14: 143-231(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

The lectures on e^+e^- annihilation, new particles, and charm covers also the hidden charm hypothesis and seeing charm. (JFP)

18576 PHYSICS WITH e^+e^--STORAGE RINGS. Schopper, H. (DESY, Hamburg). Acta Phys. Austriaca, Suppl.; 14: 233-306 (1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

The discussion of e^+e^- physics with storage rings covers a test of quantum electrodynamics, hadronic interactions, the discovery of new particles, total and leptonic widths of new particles, the nature of the new particles, a possible interpretation of the new particles: the charm model, hadronic decay channels of the new particles, inclusive spectra, and photoproduction of the new particles. (JFP)

18577 RATIONAL INTERPRETATION OF THE DIRAC EQUATION FOR THE ELECTRON. Koga, T. Int. J. Theor. Phys.; 13: No. 4, 271-278(Jul 1975).

Rationalization of the interpretation of the Dirac equation for the electron lies beyond the conventional scope of quantum mechanics. This difficulty motivates a revision of the system of quantum mechanics through which the indeterministic trait is eliminated from the system. (auth)

18578 COMPTON SCATTERING OF DEUTERONS. Saleem, M.; Shaukat, M. A. (Punjab Univ., Lahore, Pakistan). Aust. J. Phys.; 28: 475-476(1975).

The Compton scattering of deuterons is accounted for by treating the deuteron as an elementary particle. (auth)

18579 ELECTRODYNAMIC PROCESSES ON THE COLLIDING BEAMS AND ELECTRIC DIPOLE MOMENTS OF LEPTONS. Rekalo, M. P. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 7, 1109-1115(Jul 1975). (In Russian)

The electric dipole moments of the electron and muon are estimated with great transferred momenta, using the results of the experiments on checking quantum electrodynamics in the reactions $e^+ + e^- \to e^+ + e^-$, $e^+ + e^- \to \mu + \mu^-$. These experiments permitted also the extimates to be found for anapole moments of the electron (α_e) and muon (α_μ); $\alpha_\mu < 10^{-4}\ e/\mu^2$; $\alpha_e < 3 \cdot 10^{-9}\ e/m^2$, where $m(\mu)$ is electron (muon) mass. (auth)

18580 CAUSAL CLASSICAL DYNAMICS FOR CHARGED PARTICLES. Goedecke, G. H. (New Mexico State Univ., Las Cruces). Nuovo Cim.; 30B: No. 1, 108-114(11 Nov 1975).

A new general classical motion equation for particles which interact only electromagnetically is shown to lead to nonrelativistic motion equations of differential-difference type, which have only causal, nonrunaway solutions, for several charge distributions. (auth)

18581 SPECTRUM-GENERATING ALGEBRA FOR PARTICLES OF SPIN ½. Cordero, P.; Salamo, S. (Chile Univ., Santiago). Int. J. Theor. Phys.; 13: No. 4, 265-269(Jul 1975).

Spectrum-generating algebra techniques developed in previous works to deal with the problem of one particle in a potential are extended to deal with particles of spin ½. The method is illustrated considering the Pauli and Dirac equations with a Coulomb potential. The way to deal with some other potentials is indicated. In the Pauli equation an intrinsic electric dipole moment term is included. The simplicity with which the solutions are obtained is particularly remarkable. (auth)

18582 PHOTOPRODUCTION OF ELECTRON-POSITRON PAIRS IN A STRONG MAGNETIC FIELD AND FIELD OF A PLANE ELECTROMAGNETIC WAVE. Rodionov, V. N.; Ternov, I. M.; Khalilov, V. R. (Moscow State Univ.). Zh. Eksp. Teor. Fiz.; 69: No. 4, 1148-1155(Oct 1975). (In Russian)

Electron–positron pair production by an external photon moving perpendicular to a magnetic field and to the direction of propagation of a plane circularly polarized electromagnetic wave is considered within the framework of the Dirac hole theory. Formulae for the spectral-angular distributions of pairs produced in interactions between the external photon and "1 photons" of the wave are derived on basis of an exact solution of the Dirac equation describing the behavior of charged particles in fields of a given configuration. A detailed analysis is presented of one- and two-quantum ($l = 0, \pm 1$) pair production processes in all essential ranges of variation of parameters of the problem (including those of the magnetic field) which are comparable with the critical magnetic field strength $H \sim H_0 = m^2c^3/eh = 4{,}4 \cdot 10^{13}$ Gs. (auth)

18583 ISOSPIN SUM RULES AND CHARGE CORRELATIONS IN e^+e^- — HADRONS AND $\bar{N}N$ ANNIHILATION. Di Giacomo, A. (Scuola Normale Superiore, Pisa, Italy). Nuovo Cim.; 28A: No. 3, 383-405(1 Aug 1975).

One-particle and two-particle charge distributions are studied for a system of n pions of total isospin $I = 0$ and $I = 1$. Isospin invariance is fully exploited by using isospin inclusive sum rules, and is combined with positivity to give bounds on measurable quantities. The parameters which are not determined by pure isospin invariance are then expressed in terms of the partition $[N_1, N_2, N_3]$ of the number n of pions which identifies the symmetry under permutations of the charge state. The correlation parameter f_{+-}, defined by the equation $\langle n_+(n_+ - 1)\rangle - \langle n_+\rangle^2 = f_{+-}\langle n_+\rangle$, is shown to be a useful and sensitive tool for determining the charge state of the system. (auth)

18584 FINITE PARTICLE RADIUS IN ELECTRODYNAMICS AND QUANTUM MECHANICS. Monteith, H. C. Albuquerque, NM; Univ. of New Mexico (1975). 114p. University Microfilms Order No. 75-28,687.

Thesis (Ph. D.).

A new potential, derived from considerations in five-dimensional relativity theory, is studied. Since this new potential implies a finite particle radius, it was decided to determine what consequences it might have when applied to both classical electrodynamics and quantum mechanics. This new potential is called Holtzhauser's potential after the person who first derived it. Electron scattering cross sections are found in Born approximation. The explicit appearance of the electron radius in the resulting expressions is in the form of a small correction term to the relativistic Born approximation to the Rutherford scattering cross section. Applications center on radiation problems. Specifically, the question of bremsstrahlung and the virtual photon concept are examined. The usual nonrelativistic bremsstrahlung cross sections are modified by terms containing the electron radius and the results are typical of those found from extreme relativistic limits of quantum mechanical calculations. Ideas are set down in order to indicate new theoretical approaches to the illusive problem of developing a unified field theory that fits nature. The concept of torsion, a new frontier of the theoretical physics, is briefly examined and its origin explained. A new physical interpretation of the fifth dimension is provided and guidelines for future research are indicated. (Diss. Abstr. Int., B)

18585 SCHWARZSCHILD SURFACE AND DERIVATION OF MOTION EQUATIONS FROM FIELD EQUATIONS IN GENERAL RELATIVITY. Vilenkin, A. V.; Fomin, P. I. (Inst. of Theoretical Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 9, 1552-1559(Sep 1975). (In Russian)

The problem on deriving the motion equations of a charged particle from the Einstein and Maxwell field equations taking into account the existence of a horizon surface (Schwarzschild surface) at small distances is considered and the physical meaning of the derived equations is discussed. It is shown that the field region under the Schwarzschild sphere takes no part in the dynamics of a particle as viewed by an external observer. The particle manifests itself in the dynamics as an essentially nonpoint object, in a certain sense, as a topological hole in space. (auth)

18586 WEAK ELECTROMAGNETIC HYPERON DECAYS. Krive, I. V. (Kharkov State Univ.). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 6, 891-898(Jun 1975). (In Russian).

The method of sidewise dispersion relations is used for calculation of probabilities and asymmetry parameters of weak electromagnetic hyperon decays. The conducted analysis showed that in terms of verisimilar assumptions the considered method makes it possible to calculate the value of probability of $\Sigma^+ \to p\gamma$ decay that coincides with the experiment and the asymmetry parameter $\alpha(\Sigma^+ \to p\gamma)$ that matches the available measurements by absolute value. (auth)

18587 BREMSSTRAHLUNG CROSS SECTION FOR ELECTRONS SCATTERED BY HYDROGEN ATOMS. Bulmistrov, V. M.; Trakhtenberg, L. I. (Physical Chemical Inst., Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 1, 108-114(Jul 1975). (In Russian)

The cross section for one-photon bremsstrahlung of electrons scattered by hydrogen atoms is calculated in the Born approximation. The cross section is expressed as the sum over atomic intermediate states. In contrast to other work known, in the present investigation the sum is calculated with respect to all intermediate states of the atom. Therefore the results presented are not only valid when the atom may be regarded as the source of an external field, in which electron scattering occurs but, also in the general case, when the contribution of the target atom is consistently taken into account. It is mentioned that the results may be applied to quantum electronics (theory of laser breakdown in gases and emission amplification in free-free electron transitions). (auth)

18588 LOW ENERGY COMPTON SCATTERING ON SPIN ½ TARGETS. Lin, K. Y.; Lai, C. S. (National Tsing Hua Univ.,

Hsinchu, Taiwan). J. Phys., G (London); 1: No. 8, 815-820(21 Oct 1975).

The low energy Compton scattering on spin ½ targets was studied without assuming C, P and T invariances. The Born term of the scattering amplitude is calculated exactly and expressed in terms of charge, electric and magnetic dipole moments. The structure dependent part of the amplitude is given to all orders in photon energy and expressed in terms of structure dependent constants. The forward dispersion relations and low energy theorems are combined to obtain sum rules for these structure dependent constants. (auth)

18589 RADIATION FROM CHARGED PARTICLE CROSSING A SPHERICAL INTERFACE. Magomedov, M. R. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 10: No. 1, 11-16 (1975). (In Russian)

The transition radiation generated by an ultrarelativistic charged particle in its flight through spherical dielectric is considered. The exact formula for the intensity of the radiation is obtained. The cases of dielectric spheres with small and large optical densities are investigated. (auth)

18590 COMPTON-EFFECT IN MEDIUM IN THE PRESENCE OF MAGNETIC FIELD. Avetisyan, G. K. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 10: No. 1, 3-10(1975). (In Russian)

The radiation from charged particles in the field of a monochromatic wave in a medium is considered in the presence of longitudinal magnetic field. The nonlinear scattering of waves is shown to take place in the media with both refractive index $n_0 > 1$ and $n_0 < 1$ due to the multiphoton absorption of the particle near the resonance. The conditions are found for the radiation of high order harmonics of the basic wave frequency (at each frequency there are many harmonics radiated at different angles). (auth)

18591 NONRELATIVISTIC COMPTON EFFECT FOR A BOUND ELECTRON. Kaplan, I. G.; Yudin, G. L. (Scientific-Research Physical-Chemical Inst., Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 1, 9-22(Jul 1975). (In Russian)

Photon energies such that $E_b \ll E_p \ll m$ (E_b is the electron binding energy) are considered. Expressions for pA terms in the K-shell compton scattering cross section are represented in a finite algebraic form. An analytic estimate of the contributions of pA and AA terms to the cross section is obtained. It is found that in the range under consideration AA terms make the main contribution to the cross section. It is shown that for the plane wave approximation to be valid, along with the condition $E_{el} \gg E_b$, it is required that momentum be approximately conserved during scattering, a condition which is met only in the region of the compton line peak. For light elements angular distributions of scattered photons are obtained which are nonrelativistic equivalents of the Klein–Nishina distribution for scattering by bound K-electrons. It is shown that the ratio of the K-shell scattering cross section to the Klein–Nishina cross section is a universal function of the parameter $\gamma = \bar{p}_{free}/\bar{p}_{bound}$ where $\bar{p}_{free}$ is the momentum of the ejected electron at the peak of the compton line and $\bar{p}_{bound}$ is the mean value of the K-shell electron momentum. An expression for the cross section for compton scattering by the molecular electron cloud is derived in the plane wave approximation and the influence of nuclear vibrations on the cross section is analyzed. A calculation of compton scattering by the H_2 molecule shows that the line shape depends on the state in which the molecular H_2^+ ion is formed. (auth)

18592 SCATTERING OF AN INTENSE ELECTROMAGNETIC WAVE BY ELECTRONS IN A HOMOGENEOUS MAGNETIC FIELD. Oleinik, V. P.; Sinyak, V. A. (Inst. of Applied Physics, Kishinev). Zh. Eksp. Teor. Fiz.; 69: No. 1, 94-102(Jul 1975). (In Russian)

Scattering of an intense electromagnetic wave by an electron in a homogeneous magnetic field is considered. The quasi-energy spectrum of the electron is found and appreciably depends on polarization of the wave. The cause of appearance of the complex pattern of the electron band spectrum is elucidated. The energy spectrum of photons emitted by the electrons in the field of a circularly polarized electromagnetic wave is investigated. It is shown that the frequency shift ($\Delta\omega'$) of the photon, which depends on intensity (I) of the electromagnetic wave, is greatest when the electrons in the initial state possess momenta which correspond to the point of intersection of the dispersion curves in the quasi-energy spectrum. Estimates of the probabilities of the scattering process are presented. (auth)

18593 REFLECTION AND REFRACTION OF ELECTROMAGNETIC WAVES ON THE BOUNDARY OF TANGENTIAL JUMP OF VELOCITIES OF TWO MOVING DIELECTRICS. Stolyarov, S. N. Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 10: No. 1, 22-25 (1975). (In Russian)

Formulas for the amplitudes, frequencies and the wave vectors of electromagnetic waves reflected and refracted from the boundary of two moving dielectrics, e.g., two plasma fluxes, were obtained by means of Maxwell-Minkowski equations. The reflection of waves at equal concentrations of electrons in plasma fluxes and the effect of rotation of polarization plane of reflected and refracted waves are pointed out. (auth)

18594 RADIATION FROM A POINT CHARGE MOVING ALONG THE DIELECTRIC CORRUGATED SURFACE. Mergelyan, H. S. (Inst. of Radiophysics and Electronics, Novosibirsk, USSR). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 10: No. 3, 161-170(1975). (In Russian)

In perturbation theory approximation the problem of the diffraction of a charge field moving uniformly near the dielectric inhomogeneity was solved. The nature of the radiation and its spectral composition were studied, and the energy losses were calculated as well. (auth)

18595 e^+e^--ANNIHILATION INTO HADRON PAIRS ACCOMPANIED WITH HARD PHOTON RADIATION. Esaibegyan, S. B. (Erevan Inst. of Physics). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 10: No. 2, 77-83(1975). (In Russian)

The process of e^+e^--annihilation into a hadron pair with the hard photon emission is studied. The cases of ½, 1, ³⁄₂ and 2 hadron spins are considered. It is shown that at high energies this process for restricted transverse hadron momenta is the essential one and dominates over the corresponding radiationless process. (auth)

18596 POLARIZATION OF COLLIDING e^+e^- BEAMS AT SPEAR II. Learned, J.G.; Resvanis, L.K.; Spencer, C.M. (University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. Lett. 35: No. 25, 1688-1690 (22 Dec 1975).

We have studied the angular distribution for the reactions $e^+e^- \to e^+e^-$ and $e^+e^- \to \mu^+\mu^-$ at beam energies of 1.55, 3.1, and 3.7 GeV at SPEAR II. At a beam energy of 3.7 GeV a significant azimuthal asymmetry was observed indicating that the electron and positron beams are strongly polarized. The angular distribution of the μ pairs was found to be in good agreement with the predictions of quantum electrodynamics. The equilibrium value of the polarization and the polarization time constant are found to be $P_0 = 0.76 \pm 0.05$ and $\tau = 10 \pm^{+20}_{5}$ min. (auth)

18597 INVARIANT FOR A PARTICLE INTERACTING WITH AN ELECTROSTATIC WAVE IN A MAGNETIC FIELD. Taylor, J.B. (EURATOM-United Kingdom Atomic Energy Authority Fusion Association, Culham Laboratory, Abingdon, Oxon, OX14 3DB, United Kingdom); Laing, E.W. Phys. Rev. Lett. 35: No. 19, 1306-1307 (10 Nov 1975).

A particle moving in a uniform magnetic field is in resonance with an electrostatic plasma wave for an infinite sequence of parallel velocities. Consequently simple perturbation theory breaks down even if the wave amplitude is small. However a technique for calculating invariants in the presence of multiple resonances can be applied and yields results in remarkable agreement with recently published numerical orbit calculations. (auth)

18598 $\mu^+\mu^-$ DISTRIBUTIONS FROM THE PRODUCTION OF A NEW HADRON IN NEUTRINO SCATTERING. Chang, L.N.; Derman, E. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19174); Ng, J.N. Phys. Rev. Lett. 35: No. 19, 1252-1255 (10 Nov 1975).

We have analyzed dimuon distributions due to the diffractive production of a new hadronic vector boson in neutrino scattering. Characteristic features that distinguish this mechanism from heavy-lepton-mediated dimuon distributions are presented. (auth)

18599 MAGNETIC MOMENTS FOR PARTICLES DESCRIBED BY A CLASS OF RELATIVISTIC WAVE EQUATIONS. Biritz, H. (School of Physics, Georgia Institute of Technology, Atlanta, Georgia 30332). Phys. Rev. D 12: No. 8, 2254-2265 (15 Oct 1975).

We compute the magnetic moments predicted by the general linear, finite-component, manifestly covariant relativistic wave equation of first order, $(-i\beta^\mu \partial_\mu + 1)\psi(x) = 0$, with Hermitian β^0, and minimal coupling to an external electromagnetic field. Here the wave function is assumed to transform according to an arbitrarily given finite-dimensional representation of the Lorentz group. The g factors depend not only on the transformation law of the wave function but also on the mass spectrum of the wave equation. (auth)

18600 MASS-OPERATOR CALCULATION OF THE ELECTRON g FACTOR. Carroll, R. (The University of Michigan, Ann Arbor, Michigan 48104 and The University of Utah, Salt Lake City, Utah 84112). Phys. Rev. D 12: No. 8, 2344-2355 (15 Oct 1975).

We report on a mass-operator calculation of sixth-order contributions to the electron magnetic moment. We consider contributions with zeroth-order photon Green's functions and use an expansion of the mass

operator equivalent to a perturbation series in the bound interaction picture. The method for isolating magnetic moment contributions in the mass operator is described using symmetric integration techniques on integrals with noncommuting momenta. Particular attention is given to the subtraction of both ultraviolet and infrared singularities in the numerical calculation. Our result (2σ uncertainty in parentheses) is a contribution of $0.75(11)(\alpha/\pi)^3$ that gives a total sixth-order contribution of $1.02(11)(\alpha/\pi)^3$. Systematic and random errors are discussed. (auth)

18601 HOW MANY CHARM QUANTUM NUMBERS ARE THERE? Pais, A. (Rockefeller University, New York, New York 10021); Treiman, S.B. Phys. Rev. Lett. 35: No. 23, 1556-1559 (8 Dec 1975).

We address the question, how many kinds of new quantum numbers ("charm") are indicated by recent experimental developments in the study of e^+-e^- collision phenomena and dimuon production in neutrino and antineutrino reactions? (auth)

18602 MAGNETIC MOMENT OF THE PROTON IN H_2O IN BOHR MAGNETONS. Phillips, W.D.; Cooke, W.E.; Kleppner, D. (Research Laboratory of Electronics and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Rev. Lett. 35: No. 24, 1619-1622 (15 Dec 1975).

We have measured the ratio of the magnetic moment of the electron in hydrogen to the magnetic moment of the proton in H_2O to be $g(H)/g_e=658.216\ 0091(68)$ [10 parts per billion (ppb)], at a temperature of 34.7°C. This yields a value for the proton moment in Bohr magnetons of $\mu_p/\mu_B=0.001\ 520\ 992\ 983(17)$ (11 ppb). Our result differs from the currently accepted value by 150 ppb. (auth)

18603 PION AND NUCLEON STRUCTURE FUNCTIONS NEAR $x = 1$. Farrar, G.R.; Jackson, D.R. (California Institute of Technology, Pasadena, California 91125). Phys. Rev. Lett. 35: No. 21, 1416-1419 (24 Nov 1975).

In a colored-quark and vector-gluon model of hadrons we show that a quark carrying nearly all the momentum of a nucleon ($x\simeq 1$) must have the same helicity as the nucleon; consequently $\nu W_2{}^n/\nu W_2{}^p\to 3/7$ as $x\to 1$, not 2/3 as might naively have been expected. Furthermore as $x\to 1$, $\nu W_2{}^n\sim (1-x)^2$ and $(\sigma_L/\sigma_T)^n\sim\mu^2Q^{-2}(1-x)^{-2}+O(g^2)$; the resulting angular dependence for $e^+e^-\to h^*+X$ is consistent with present data and has a distinctive form which can be easily tested when better data are available. (auth)

18604 CHARGE FORM FACTOR OF THE DEUTERON AND OPTIMIZED POLYNOMIALS. Hockert, J.; Jackson, A. D. (State Univ. of New York, Stony Brook (USA). Dept. of Physics). Phys. Lett., B; 58: No. 4, 387-389(29 Sep 1975).

Using pseudodata based on the Reid soft-core potential, the authors consider the extent to which a single measurement of the tensor polarization of recoil deuterons can facilitate the separation of deuteron charge and quadrupole form factors in the range 0 less than q^2 less than 35 fm^{-2}. (NL)

18605 PROPERTIES OF psiN SCATTERING. Barger, V. (Wisconsin Univ., Madison (USA). Dept. of Physics); Phillips, R. J. N. (Science Research Council, Chilton (UK). Rutherford Lab.). Phys. Lett., B; 58: No. 4, 433-436(29 Sep 1975).

Extracting psi N scattering from photoproduction requires vector meson dominance and diffractive assumptions. It is observed that (i) kinematic corrections to standard vector dominance formulas are important; (ii) both threshold and high-energy behaviors of sigma/sub t/(psi N) support the diffractive assumption; (iii) q^2 dependence in the gamma psi coupling could imply larger psi N cross sections; and (iv) in any case sigma/sub t/ is bounded through the slope of d sigma/dt and sigma/sub el// sigma/sub t/ remains small. (NL)

18606 HADRONIC VACUUM POLARIZATION EFFECTS IN BHABHA AND MOLLER SCATTERING. Budny, R. (Stanford Univ., Calif. (USA). Inst. of Theoretical Physics). Phys. Lett., B; 59: No. 2, 168-170(27 Oct 1975).

Effects of hadronic vacuum polarization in the reactions e^+e^- yields e^+e^- and $e^+e^-e^+e^-$ yields $e^+e^-e^+e^-$ are discussed. The cross sections with spin polarization are given. Measurements of these effects could directly determine in the hadronic vacuum polarization at spacelike momentum transfers and could improve tests of quantum electrodynamics. (NL)

18607 GYROMAGNETIC RATIONS AND NATURE OF BACK BENDING OF THE MOMENT OF INERTIA. Grin', Y.T. (I. V. Kurchatov Institute of Atomic Energy). JETP Lett. 22: No. 2, 49-50 (20 July 1975).

It is shown that the gyromagnetic ratio for the rotational excitations take on values that differ significantly from Z/A in the case when the nature of the back bending of the moment of inertia is connected with intersection with the state of broken pair of nucleons at a level with angular momentum $j=l+1/2$. The dependence of g on the nuclear spin is calculated. (auth)

18608 ANALYSIS OF THE PION FORM FACTOR IN THE TIME-LIKE REGION. Lang, C. B.; Stefanescu, I. S. (Karlsruhe Univ. (TH) (F. R. Germany)). Phys. Lett., B; 58: No. 4, 450-454(29 Sep 1975).

A model-independent analysis of the pion electromagnetic form factor is performed using the available space-like and time-like data. The aim is to obtain information on the structure in the time-like region above the $\pi\omega$ threshold. The phase below is assumed to be known from $\pi\pi$ scattering. In the process of analytic continuation the authors use as stabilizing lever different types of bounds on the derivative of the form factor. (NL)

18609 COMPTON SCATTERING OPACITY. Buchler, J. R.; Yueh, W. R. (Florida Univ., Gainesville (USA). Dept. of Physics and Astronomy). Phys. Lett., B; 58: No. 4, 463-466(29 Sep 1975).

It is shown first that there is an error in the literature in the evaluation of the Compton scattering opacity; second, the corrected values are compared with the published ones; and, third, it is shown that two commonly made approximations are inaccurate in the case of electron degeneracy. (NL)

18610 RESONANCES IN e^+-e^- SYSTEM DUE TO ANOMALOUS MAGNETIC MOMENT INTERACTIONS. Barut, A. O.; Kraus, J. (Muenchen Univ. (F. R. Germany). Sektion Physik). Phys. Lett., B; 59: No. 2, 175-178(27 Oct 1975).

The Dirac equation has been solved for a lepton with an anomalous magnetic moment in the Coulomb field of the antilepton. The existence of resonance states of hadronic size and of energies of a few GeV due to the interplay of effective attractive and repulsive dynamical potentials of the r^{-2}, r^{-3}, and r^{-4} type is demonstrated. No new parameters are involved. Almost similar resonances are predicted in the lepton–lepton systems for opposite values of the quantum number kappa. (NL)

18611 POSSIBILITY OF SCALING VIOLATION IN DEEP-INELASTIC e^+e^- ANNIHILATION. Jersak, J. (Technische Hochschule Aachen (F. R. Germany). Inst. fuer Theoretische Physik). Nucl. Phys., B; 98: No. 1, 100-108(27 Oct 1975).

The possibility of scaling violation in deep inelastic annihilation (DIA) while scaling holds in electroproduction is discussed in the framework of the non-forward Compton amplitude. The difference arises if the asymptotic behavior of the triple discontinuity of the Compton amplitude is singular in the forward direction. Duality provides some understanding of such a singularity and excludes scaling in DIA near threshold. (NL)

18612 COMMENT CONCERNING THE EVALUATION OF THE CABIBBO–RADICATI SUM RULE. Genz, H. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). Nucl. Phys., B; 97: No. 3, 541-546(20 Oct 1975).

The Gilman–Schnitzer evaluation of the Cabibbo–Radicati sum rule is discussed. It is argued that the SU(2) generalization of the $\Delta N\pi\gamma$ contact term has to be included in the evaluation. Doing so considerably decreases (15% rather than 8% discrepancy) the agreement of the sum rule with the data. (NL)

18613 RELATING INCLUSIVE AND EXCLUSIVE MESON PHOTOPRODUCTION AT LARGE TRANSVERSE MOMENTUM. Scott, D. M. (Science Research Council, Chilton (UK). Rutherford Lab.). Phys. Lett., B; 59: No. 2, 171-174(27 Oct 1975).

Inclusive and exclusive meson photoproduction at large transverse momentum are related by a local application of the correspondence principle of Bjorken and Kogut. The recent predictions for the inclusive process by Escobar are thus compared with wide-angle exclusive data. The inclusive photoproduction of $(\rho^0+\omega)$ at large transverse momentum is discussed. (NL)

18614 NEW ABSOLUTE BOUND ON THE $\pi^0\pi^0$ S-WAVE SCATTERING LENGTH. Lopez, C.; Mennessier, G. (Paris-6 Univ., 75 (France). Lab. de Physique Theorique et Hautes Energies). Phys. Lett., B; 58: No. 4, 437-441(29 Sep 1975).

The precedent absolute lower bounds on the $\pi^0\pi^0$ S-wave scattering length have been improved substantially. The main new feature in the derivation is the exploitation of the know structure of the partial-wave left-hand-cut discontinuity, explicitly exhibited by the Roy equations. The final result is $a_0{}^{00} > -1.75$. (NL)

18615 COMPARISON BETWEEN $\gamma N\to\pi N$ AND $\pi N\to\rho N$ IN THE RESONANCE REGION UP TO $\sqrt{s}$ = 1.75 GeV VIA THE VECTOR-DOMINANCE-MODEL. Longacre, R. S.; Dolbeau, J. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Physique des Particules Elementaires). Phys. Lett., B; 58: No. 4, 455-458(29 Sep 1975).

The helicity amplitudes are displayed for the $N\rho$ system for each J^P state of the $N\pi$ system in the reaction $N\pi\to N\rho$. These amplitudes are obtained from a K-matrix fit to amplitudes of the reaction $N\pi\to N\pi$ and $N\pi\to N\pi\pi$ (via the isobar model). The authors then take either these amplitudes or the resonance

couplings estimated from these amplitudes and compare them to the photoproduction amplitudes via the V. D. M. Two possible kinematics are considered for the Nρ system below its threshold. These four methods give a range in which the V. D. M. can be accommodated even at this low energy. (NL)

18616 PHOTOPRODUCTION OF LARGE TRANSVERSE MOMENTUM MESONS AND PRODUCTION OF LARGE-p_T PHOTONS AND LEPTONS IN PROTON–PROTON COLLISIONS. Escobar, C. O. (Cambridge Univ. (UK). Dept. of Applied Mathematics and Theoretical Physics). Nucl. Phys., B; 98: No. 1, 173-188(27 Oct 1975).

The photoproduction of large-transverse-momentum mesons is examined in a leading particle model by using the techniques of the covariant parton model. In the leading particle model the large-p_T meson is produced in a high-energy, wide-angle scattering: $\gamma + q \rightarrow M + q$. Numerical results such as inclusive cross sections, angular distributions and particle ratios are presented for the pseudoscalar mesons. The Landshoff–Polkinghorne quark-fusion model is then applied to the production of large transverse momentum photons and leptons in proton–proton collisions. In the lepton case this model differs from the usual Drell–Yan mechanism in that the lepton pair has a small invariant mass but comes from a large-p_T virtual photon. (NL)

18617 PHOTON–PHOTON CROSS SECTIONS IN THE RESONANCE REGION. Goldschmidt, Y.; Rubinstein, H. R. (Weizmann Inst. of Science, Rehovoth (Israel). Dept. of Physics). Nucl. Phys., B; 97: No. 3, 445-451(20 Oct 1975).

In this paper possible contributions to the photon–photon cross section in the region where the vector-dominated thresholds ($M_b \gamma\gamma \leq 2.5$ GeV) are closed are evaluated. All two-body processes are summed explicitly diagonal and off-diagonal, and the multibody processes are evaluated by a method introduced previously. It is found that excluding s-channel resonances the cross section is very small for all channels and purely real except for resonance contributions. It is concluded that the possibility of studying s-channel resonances in electron collision machines is probably far better than it was believed. These possibilities are discussed in a separate paper. (NL)

18618 IS ANTIPROTON ANNIHILATION CENTRAL OR PERIPHERAL. Warren, G.; Gregory, P.; Mason, P.; Muirhead, H.; Michael, C. (Liverpool Univ. (UK)); Carlsson, R.; Ekspong, G.; Holmgren, S. O.; Nilsson, S.; Stenbacka, R. Nucl. Phys., B; 97: No. 3, 381-391(20 Oct 1975).

A lower bound on the average impact parameter of $\bar{p}p$ annihilation is estimated from data on $\bar{p}p$ annihilation to pions at 4.6 and 9.1 GeV/c. This bound is more central than for non-annihilation events. This result is in contrast to the simple interpretation of identifying the annihilation channels as responsible for the difference between $\bar{p}p$ and pp scattering, since elastic scattering data show that this difference is particularly peripheral in impact parameters. (NL)

18619 ψ PARTICLES AND NEW QUARK MODELS. Krasnikov, N.V.; Kuz'min, V.A.; Chetyrkin, K.G. (Nuclear Research Institute of the USSR Academy of Sciences). JETP Lett. 22: No. 2, 47-48 (20 July 1975).

It is shown that within the framework of models with five or six quarks it is possible to find a natural explanation for the leptonic widths of $\psi(3095)$ and $\psi'(3695)$ and for the invariance of the $\bar{K}$-meson yield in the process $e^+e^- \rightarrow$ hadrons in the energy interval from 3 to 4.8 GeV. The value of $R \equiv \sigma(e^+e^- \rightarrow \text{hadrons})/\sigma(e^+e^- \rightarrow \mu^+\mu^-)$ can be reconciled with the experimental data with and without taking the colors of the quarks into account. (auth)

Weak

Refer also to abstracts 18372, 18374, 18488, 18601, 18881, 18888, and 19329.

18620 (IN-2P3-EC-74(Vol.1), pp 1-175) INTRODUCTION TO WEAK INTERACTIONS. Leite Lopes, J. [nd]. (In French).

From summer school on particle physics; Gif-sur-Yvette, France (9 Sep 1974).

Distributed by M. M. S. Detoeuf, IN2P3, 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05.

In summer school on particle physics. Gif-sur-Yvette, 9-21 September 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

An account is first given of the electromagnetic interactions of complex, scalar, vector and spinor fields. It is shown that the electromagnetic field may be considered as a gauge field. Yang-Mills fields and the field theory invariant with respect to the non-Abelian gauge transformation group are then described. The construction, owing to this invariance principle, of conserved isospin currents associated with gauge fields is also demonstrated. This is followed by a historical survey of the development of the weak interaction theory, established at first to describe beta disintegration processes by analogy with electrodynamics. The various stages are mentioned from the discovery of principles and rules and violation of principles, such as those of invariance with respect to spatial reflection and charge conjugation, to the formulation of the effective current-current Lagrangian and research on the structure of weak currents. (FR)

18621 (IN-2P3-EC-74(Vol.1), pp 177-202) THE WEAK CURRENTS. Cabibbo, N. [nd]. (In French).

From summer school on particle physics; Gif-sur-Yvette, France (9 Sep 1974).

Distributed by M. M. S. Detoeuf, IN2P3, 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05.

In summer school on particle physics. Gif-sur-Yvette, 9-21 September 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

The main facts known on the structure of the weak hadronic current are given. An attempt is made to elucidate the physical meaning of different hypotheses such as C. V. C., PCAC, SU(3) and angle theta, chiral algebra, which have led to progress in the understanding of weak interactions. The central problem to overcome in order to specify the structure of the hadronic current is the fact that gaps remain in the knowledge of strong interactions. However a solution has been found by assuming that the weak current is a combination of the currents associated with exact or approximate symmetries of strong interactions. (FR)

18622 (IN-2P3-EC-74(Vol.1), pp 203-270) REVIEW OF EXPERIMENTAL SITUATION OF WEAK INTERACTIONS. Turlay, R. [nd]. (In French).

From summer school on particle physics; Gif-sur-Yvette, France (9 Sep 1974).

Distributed by M. M. S. Detoeuf, IN2P3, 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05.

In summer school on particle physics. Gif-sur-Yvette, 9-21 September 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

Weak interaction research has been centered during the last ten years on particle disintegration studies and essentially on K mesons and hyperon. So much has emerged from K meson physics that most of the examples have been chosen from experiments on these particles neutral or charged, besides which it seems essential to discuss hyperon physics and its development. Moreover independently of Cabibbo's theory some of the most important laws have held the attention of all scientists for a long time. Consequently the following choice was made: general review of the suppression of neutral currents $\Delta S = 1$; rule $\Delta I = \frac{1}{2}$. Study in $K \rightarrow 3\pi$; rule $\Delta S = \Delta Q$; leptonic disintegration of hyperons. (FR)

18623 (IN-2P3-EC-74(Vol.1), pp 297-324) PRICE OF GAUGE THEORIES OF WEAK AND ELECTROMAGNETIC INTERACTIONS. Maiani, L. [nd].

From summer school on particle physics; Gif-sur-Yvette, France (9 Sep 1974).

Distributed by M. M. S. Detoeuf, IN2P3, 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05.

In summer school on particle physics. Gif-sur-Yvette, 9-21 September 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

The current picture of weak interactions has met with an unquestionable success in reproducing the phenomenology of first order weak processes. Its extension into a full-fledged field theory is however made almost impossible (with present field theory technology) by the unrenormalizability of the four fermion coupling. In the search of new formulations of a weak interaction theory, a prominent place has always been taken by the intermediate boson theory, where, in analogy to electromagnetism, weak interactions are thought to be mediated by a vector particle (or particles). This idea has led to the formulation of unified gauge theories of weak and e-m phenomena which have recently been shown to be renormalizable. The possibility of casting weak interaction theory at the same level of understanding as quantum electrodynamics has been thus opened up, which would, no doubt, constitute a wonderful progress in this field. Although gauge models of weak and e-m interactions compatible with present experimental findings have been formulated, all these models invariably predict the existence of new phenomena not present in the conventional current x current picture and whose existence is, in a way, a prerequisite for a gauge theory of weak and e-m interactions to be meaningful. These new phenomena are intermediate bosons in well defined range of masses, neutral currents and/or heavy leptons, and charmed particles. The existence of neutral currents seems by now well established. (FR)

18624 (IN-2P3-EC-74(Vol.1), pp 325-371) NEUTRINO INTERACTIONS AT ANL, BNL AND CERN. Musset, P. [nd].

From summer school on particle physics; Gif-sur-Yvette, France (9 Sep 1974).

Distributed by M. M. S. Detoeuf, IN2P3, 11 rue Pierre et Marie Curie, 75231 Paris Cedex 05.

In summer school on particle physics. Gif-sur-Yvette, 9-21 September 1974. (Institut National de Physique Nucleaire et de Physique des Particules, 75 – Paris (France)).

Numerous experimental results have been obtained in the two past years in the Argonne, Brookhaven and CERN neutrino beams. One is the first observation in the CERN beam of an important rate of neutrino-like interactions which have no charged leptons in the final state in both neutrino and antineutrino beams. The most natural explanation of these events with $\Delta Q = 0$ is the existence of neutral weak currents. Whatever the theoretical interpretation will be, these observations open a still uncovered field of the weak interactions, hopefully not only in neutrino reactions, a field comparable to that of the charge changing current interactions $\Delta Q = 1$. The fact that the observed rates of these events easily fall into the range of expected values in some gauge theories may also be important in the attempts to unify different kinds of interactions. The experimental observations of Gargamelle have been corroborated by analogous observations at ANL and BNL this year. The $\Delta Q = 1$ interactions have also been studied in connection with the fundamental properties of the weak interactions such as the Cabibbo universality, the electronic-muonic neutrino universality, the scaling hypothesis, and the structure of the nucleon. In particular the simple quark parton model describes numerous data without difficulty. (FR)

18625 PHENOMENOLOGY OF WEAK CURRENTS. Gourdin, M. (Laboratoire de Physique Theorique et Hautes Energies, Paris). Acta Phys. Austriaca, Suppl.; 14: 307-395(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

Lectures are given in reaction to the attitude of experimentalists to translate their results in terms of fashionable models. An analysis of the data is presented as model independent as possible in order to determine the main properties of the weak neutral current. General features and peculiar models are only considered as illustration of more general properties. Restriction is made to inclusive reactions indiced by neutrinos and antineutrinos. (JFP)

18626 IS THERE EVIDENCE FOR QUARK–PARTON STRUCTURE IN INCLUSIVE NEUTRAL-CURRENT NEUTRINO REACTIONS. Reya, E.; Schilcher, K. (Univ., Mainz). Lett. Nuovo Cim.; 13: No. 18, 687-692(30 Aug 1975).

It is proposed and emphasized that the most recent high energy experiment for muonless deep inelastic neutrino and antineutrino scattering off nucleons furnishes further possible evidence of nonpointlike hadron constituents, not apparent in lower energy results. It is shown that the discrepancies in data of neutral-to-charged current ratios, taken at a mean energy of 50 GeV, differing from lower energy results as well as from Weinberg model predictions by about two standard deviations, and violating model-independent isospin bounds, can be naturally explained by assuming that at present energies the weak currents already feel the structure of the constituents of the nucleon, leading to a breakdown of scaling. It is pointed out that a constituent structure with a size of $1/\Lambda \simeq 3(10)^{-15}$cm and a possibly finite anomalous magnetic moment emerges as a natural and economic hypothesis to explain not only scale-breaking effects in various electromagnetic processes, but also the new neutral and charged current data. (JFP)

18627 NEUTRAL WEAK CURRENTS. Sedrakyan, A. G. (Erevan State Univ.). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 10: No. 3, 155-160(1975). (In Russian)

Connected with the experimental indications of the existence of the neutral weak current in reactions $\bar{\nu}_\mu e^- \to \bar{\nu}_\mu e^-$, $(\nu_\mu/\nu_\mu) + N \to (\nu_\mu/\nu_\mu)$ – hadrons, the predictions of Weinberg's model for electron-electron scattering are studied. The correction to the differential cross section and the average polarization of the scattered particle are obtained. These effects at high energy would serve as direct evidences of the existence of the neutral weak current. (auth)

18628 UNIVERSAL THEORY OF WEAK INTERACTIONS IN THE PARACHARGE SCHEME AND QUARK–LEPTON ANALOGY. Das, T.; Divakaran, P. P.; Pandit, L. K.; Virendra Singh. (Tata Inst. of Fundamental Research, Bombay). Pramana; 5: No. 2, 87-100(Aug 1975).

A universal theory of weak interaction is constructed by exploiting an analogy inherent between the four leptons and the four quarks of the paracharge scheme proposed recently to deal with the ψ-particles. The leptons (ν_e, ν_μ, e_L, μ_L) are assigned to the representation ($\frac{1}{2}$, $\frac{1}{2}$) and the quarks $(p, n_W)_L$ and $(\chi, \lambda_W)_L$ to the representations ($\frac{1}{2}$, 0) and (0, $\frac{1}{2}$), respectively, of the group O_4 (L stands for the left-handed projections and W for the Cabibbo rotated orthogonal combinations of n and λ). Universality is ensured by embedding the above (weak) O_4 into the simple group O_5 and gauging the latter. In the final effective weak interaction, besides the conventional V-A charged-current part, a (V-A) neutral current interaction (consistent with the present data) is naturally present. The neutral current has a $\bar{\nu}_\mu\nu_\mu$ term but no $\bar{\nu}_e\nu_e$ term, thus providing a crucial test of the theory. (auth)

18629 ELEMENTARY PARTICLES DECAY IN THE FIELD OF AN INTENSE ELECTROMAGNETIC WAVE. Lyul'ka, V. A. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 3, 800-809(Sep 1975). (In Russian)

The decays $\mu^\pm \to e^\pm + \nu + \bar{\nu}$, $\pi \to \mu(e) + \nu$, $\pi^\pm \to \pi^0 + e^\pm + \nu$ and also the process $e^\pm \to e^\pm + \nu + \bar{\nu}$ occurring in the field of an intense electromagnetic wave of arbitrary polarization or in the field of two linearly polarized waves with mutually perpendicular polarizations moving in the same direction are considered. Expressions for the probabilities of the decays are obtained for both electromagnetic field models. Numerical calculations are carried out for concrete values of the invariant parameters determining the action of the external field on the elementary particle decays. Characteristic features of the dependence of the total particle decay probabilities on frequency and also polarization of the external electromagnetic field are discussed. (auth)

18630 COMPARISON OF SOME INTERACTION CHARACTERISTICS OF DIFFERENT NATURE COSMIC HADRONS WITH LIGHT NUCLEI AT ENERGIES EXCEEDING 1 TeV. Grigorov, N. L.; Mitoyan, S. V.; Savel'eva, A. I.; Shestoperov, V. Ya. (Scientific-Research Inst. of Nuclear Physics, Moscow). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 5, 363-368(1974). (In Russian)

The experimental data on some characteristics of the interactions of single hadrons and the groups of hadrons with light nuclei are given. The obtained data show that nucleons and pions generate high energy γ-quanta in processes with similar average characteristics. (auth)

18631 FEASIBILITY OF OBSERVING EFFECTS OF ORDER G^2 IN $K^+ \to \pi^+ l^+ l^-$ DECAYS. Shabalin, E.P. (Institute of Theoretical and Experimental Physics). JETP Lett. 22: No. 2, 53-53 (20 July 1975).

It is shown that the ratio of the spectra of the $K^+ \to \pi^+ \mu^+ \mu^-$ and $K^+ \to \pi^+ e^+ e^-$ decays is quite sensitive to the contribution of the weak interaction of second order in G. (auth)

18632 A POSSIBLE MECHANISM FOR THE $\Delta T = 1/2$ RULE IN NONLEPTONIC DECAYS OF STRANGE PARTICLES. Vainshtein, A.I.; Zakharov, V.I.; Shifman, M.A. (Institute of Theoretical and Experimental Physics). JETP Lett. 22: No. 2, 55-56 (20 July 1975).

It is shown that allowance for strong interactions introduces into the effective weak-interaction Hamiltonian new terms that contain both left- and right-helical particles. Estimates in the simple quark model show that the contribution of these terms to the amplitudes of the $K \to 2\pi$ and $K \to 3\pi$ decays can dominate and lead to the $\Delta T = 1/2$ rule. In this case, there are no grounds for expecting an enhancement of nonleptonic decays of charmed particles over their leptonic decays. (auth)

18633 SECOND-RANK INTERACTIONS IN INCLUSIVE MUONLESS NEUTRINO REACTIONS. Gronau, M.; Levy, N. (Technion-Israel Inst. of Tech., Haifa. Dept. of Physics). Nucl. Phys., B; 97: No. 3, 513-521(20 Oct 1975).

Second-rank S-P-T interaction effects in inclusive muonless neutrino processes may show up as typical anomalies in y distributions and in the ν to $\bar{\nu}$ ratio of total cross sections. Strangeness and color are referred to as being two possibilities for the origin of the non-diagonal character of the second-rank neutral currents. (NL)

18634 SU(2) × U(1) GAUGE THEORY OF THE WEAK AND ELECTROMAGNETIC INTERACTIONS WITH SPONTANEOUS PARITY BREAKING. Herbert, J. M. (Sussex Univ., Brighton (UK). School of Mathematical and Physical Sciences). Nucl. Phys., B; 97: No. 3, 426-438(20 Oct 1975).

An SU(2) × U(1) gauge theory of weak and electromagnetic interactions in which parity is broken spontaneously is constructed. The model satisfies the usual experimental requirements. (NL)

18635 NEUTRINO MAGNETIC MOMENT, PLASMON CERENKOV RADIATION, AND THE SOLAR-NEUTRINO PROBLEM. Radomski, M. (California Institute of Technology, Pasadena, California 91125). Phys. Rev. D 12: No. 8, 2208-2211 (15 Oct 1975).

Clark and Pedigo suggested that, if the neutrino has a magnetic moment, the energy loss of a solar neutrino in escaping the sun, due to magnetic elastic scattering off electrons, could help explain the absence of detection of solar neutrinos at earth. Collective effects of the solar

plasma will modify the energy loss calculated by those authors. The existence of the possibility of Čerenkov radiation of longitudinal plasmons suggests that the effect might be large and positive. Detailed calculation shows that it is actually a small effect on the energy loss and not of likely impact on the solar-neutrino problem. (auth)

18636 "ENERGY CRISIS" AND HEAVY LEPTONS. Fujikawa, K. (Institute for Nuclear Study, University of Tokyo, Tanashi, Tokyo 188, Japan); Kawamoto, N. Phys. Rev. Lett. 35: No. 23, 1560-1563 (8 Dec 1975).

A pair of heavy leptons with a mass of 1.8 GeV can explain the step-function-like behavior of the charge-particle energy fraction in e^+e^- annihilation except for the resonance region around 4.1 GeV. The preliminary result of the e-μ events reported by Perl, in particular the effects of spin alignment, are discussed in terms of this heavy lepton. We comment on a possible way to distinguish the heavy lepton from heavy hadrons. (auth)

18637 COMMENT ON DIRECT LEPTON PRODUCTION. Lederman, L.M.; White, S. (Columbia University, New York, New York 10027). Phys. Rev. Lett. 35: No. 22, 1543-1546 (1 Dec 1975).

Recent data on observations of direct leptons produced in proton-proton collisions are analyzed. It is found that the large bulk of the data can be accounted for if the origin of the leptons is a low-mass, ~ (1 to 5) m_π, vector meson which decays weakly into $\mu+\nu$ and $e+\nu$ symmetrically. The proposed object is produced and decays with a cross section times branching ratio of 10^{-3} of the pion production cross section. (auth)

18638 ELECTRON-MUON MASS RATIO IN A GAUGE GROUP FOR LEPTONS. Fayyazuddin; Riazuddin (Institute of Physics, University of Islamabad, Islamabad, Pakistan). Phys. Rev. D 12: No. 8, 2496-2504 (15 Oct 1975).

We postulate a concept of isospin in purely leptonic space. In particular, we consider a group $G \equiv [SU_L(2) \otimes U(1)][SU_{lR}(2) \otimes SU_{lR}(2) \otimes U_l(1)]$ for leptons. The first group is the group introduced by Salam and Weinberg and generates ordinary weak and electromagnetic interactions. The second group is in leptonic space only such that the leptonic multiplet $L=[(1+\gamma_5)/2]\begin{pmatrix}\nu_\mu\\ e\end{pmatrix}$ belongs to a representation $T_{lL} = 1/2$, $T_{lR} = 0$, $Y_l = 1$ of this group and a representation $T_L = 1/2$, $Y = -1$ for the group $SU_L(2) \otimes U(1)$. The multiplet $R = (1/2)(1-\gamma_5)\begin{pmatrix}\mu\\ e\end{pmatrix}$ has $T_L = 0$, $Y = -2$ for the group $SU_L(2) \otimes U(1)$ and has $T_{lL} = 0$, $T_{lR} = 1/2$, $Y_l = 1$ for the other group. T_{lL} and T_{lR} are left-handed and right-handed isospins, and Y_l is the hypercharge for the leptonic group. The leptonic charge $Q_l = T_{lL3} + T_{lR3} + Y_l/2$. Thus for the muon $Q_l = 1$ and for the electron $Q_l = 0$ so that muonic number acquires a group-theoretic meaning. We consider the spontaneously broken gauge symmetry based on the group G such that in zeroth order only the muon acquires a mass and the electron remains massless. We calculate the electron self-mass due to radiative corrections in second order of the gauge coupling constant f of the leptonic group. Our conculsion is that for the electron mass to be calculable, the electron remains massless even in second order so that the electron mass may arise in fourth order of f. (auth)

18639 NEUTRINO PRODUCTION IN STELLAR MATTER BY PHOTONS IN A RENORMALIZABLE SCALAR-BOSON-EXCHANGE MODEL OF WEAK INTERACTIONS. Biswas, S.N.; Chaudhuri, S.R.; Taank, J.K.S. (Department of Physics and Astrophysics, University of Delhi, Delhi-7, India); Campbell, J.A. Phys. Rev. D 12: No. 8, 2523-2525 (15 Oct 1975).

A report of a calculation of the rate of loss of energy in stellar matter through neutrino production by two-photon annihilation is presented. It is the scalar-boson-exchange model of Kummer and Segrè for weak interactions. The results show that this mechanism for loss of energy is unlikely to be significant astrophysically. Comparison with a phenomenological calculation suggests that the mass of the scalar boson may be about 19 GeV. (auth)

Strong (General)

Refer also to abstracts 18488 and 19354.

18640 (PP-453) QUARK CONFINEMENT: HADRONS AS "STRONG BLACK-HOLES". Recami, E.; Castorina, P. (Catania Univ. (Italy). Instituto di Fisica). Dec 1975. 10p. Dep. NTIS (US Sales Only) $3.50.

Preliminary work is presented on whether quarks can be confined in hadrons, e.g. in nucleons, as a consequence of the fact that hadrons might be considered as strong black holes, i.e., as black holes due not to a gravitational field interacting with gravitational charges (masses), but to the strong field interacting with the strong charges carried by quarks. (JFP)

18641 STRONG INTERACTIONS IN COSMIC RAYS AND ACCELERATOR EXPERIMENTS. Dobrotin, N. A.; Slavatinskii, S. A. (Lebedev Inst. of Physics, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1630-1636(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1836-1843(Sep 1970).

The discussion of strong interactions includes multiple meson production, the fireball model, peripheral collisions, and the multiperipheral model, multi-Regge model. (JFP)

18642 TEST OF ASYMPTOTIC FREEDOM OF STRONG INTERACTIONS. Phat, T. H. (Inst. of Theoretical Physics, Warsaw). Nuovo Cim.; 28A: No. 3, 337-363(1 Aug 1975).

On the basis of the general principles of quantum field theory, the possibility of existence of Bjorken scaling and a test for asymptotic freedom of strong interactions are considered. In contrast with Gross and Wilczek, it is shown that exact Bjorken scaling is possible and that Bjorken scaling, up to logarithmic terms, takes place not only in asymptotically free field theories, but also in other field theories, where the invariant coupling constant goes to infinity in a well-defined manner. Furthermore, the asymptotic freedom leads to a slow decrease of the differential cross section as s and t tend to infinity. It is suggested that the mechanism of small-angle interactions is essentially different from that of large-angle interactions. (auth)

18643 OFF-SHELL AMPLITUDES AND CURRENTS IN THE DUAL-RESONANCE MODEL. Collins, P. V.; Friedman, K. A. (Weizmann Inst. of Science, Rehovoth, Israel). Nuovo Cim.; 28A: No. 2, 173-192(21 Jul 1975).

The possibility of constructing off-shell amplitudes and currents in the conventional dual model is considered. The necessary form is determined for a current which incorporates the current algebra constraints in addition to the constraints arising from duality and factorization. The current consists of two parts—an off-shell amplitude and a part that exhibits the current algebra properties. It is proven that a dual, factorizable off-shell amplitude which has the same spectrum as the conventional on-shell dual-resonance model does not exist. (auth)

18644 NATURE OF PHYSICAL STATES IN THE DUAL-RESONANCE MODEL. Collins, P. V.; Friedman, K. A. (Weizmann Inst. of Science, Rehovoth, Israel). Nuovo Cim.; 28A: No. 2, 193-202(21 Jul 1975).

The nature of the physical states in the dual-resonance model are analyzed. It is argued that the explicit k-dependence of the DDF states requires that they should not be identified with the physical states. The operator $\tau(k)$ of Brink and Olive is a projection operator onto the DDF states, which are not a covariant representation of the physical states. It is shown under what conditions $\tau(k)$ may be used a covariant physical-state projection operator on shell. We use our results to show that the dual-resonance model has no covariant continuation off shell which retains the spectrum of the physical states. (auth)

18645 QUARKS AS CONSEQUENCE OF DUALITY AND FACTORIZATION. Yu, S. (Univ. of Pittsburgh). Nuovo Cim.; 28A: No. 2, 203-214(21 Jul 1975).

Duality combined with factorization imposes very stringent conditions on the N-meson amplitude. An attempt to make both duality and factorization manifest in the Baker-Coon dual-resonance model results naturally in an operator representation of the N-meson amplitude which is remarkably quarklike. The representation is described in terms of N sets of operators which are topologically similar to the N quark lines in a Harari-Rosner diagram. These operators may be "pinched" to generate meson poles, and the resulting mesons can be consistently identified as "quark-antiquark pairs." It is suggested that the quark diagram structure is a natural consequence of duality and factorization. (auth)

18646 PHOTOPRODUCTION OF THE ψ (3100) MESON AT 11 GeV. Gittelman, B.; Hanson, K.M.; Larson, D.; Loh, E.; Silverman, A.; Theodosiou, G. (Laboratory of Nuclear Studies, Cornell University, Ithaca, New York 14853). Phys. Rev. Lett. 35: No. 24, 1616-1619 (15 Dec 1975).

The photoproduction of the ψ (3100) meson from a beryllium target has been measured using an 11.8-GeV bremsstrahlung beam. The energy and angular dependence of the measured spectra may be obtained from an elastic nucleon cross section of the form $d\sigma/dt = (1.01 \pm 0.20) \exp[(1.25 \pm 0.20)t]$ nb/GeV^2. This cross section is exceedingly small in comparison with those of the other vector mesons. (auth)

18647 QUARKS WITH CHARM AND COLOR: A NEW MODEL OF THEIR STRONG AND WEAK INTERACTIONS. Ma, E. (California Univ., Santa Barbara (USA). Dept. of Physics). Phys. Lett., B; 58: No. 4, 442-444(29 Sep 1975).

The motivation and the consequences of taking the charmed quark to be a 6* under color SU(3) are discussed. Among the many features of this new quark scheme is that charmed mesons are heavier than charmed baryons. (NL)

18648 POSSIBLE DEGENERACY OF HEAVY QUARKS. Wilczek, F. (Princeton Univ., N. J. (USA). Joseph Henry Labs.). Phys. Lett., B; 59: No. 2, 179-181(27 Oct 1975).

In an attempt to understand the behavior of the total cross-section in the electron–positron annihilation, it is suggested that two types of heavy quarks might exist with masses split only by the weak interactions. Implications and tests of this suggestion are discussed. (NL)

18649 ELASTIC SCATTERING SLOPE AND TOTAL CROSS SECTION RELATIONS. Barger, V. (Wisconsin Univ., Madison (USA). Dept. of Physics); Phillips, R. J. N. (Science Research Council, Chilton (UK). Rutherford Lab.). Nucl. Phys., B; 97: No. 3, 452-460(20 Oct 1975).

The empirical equality of B^2/sigma/sub t/ is noted for the pomeron terms in NN, pi N, KN, rho N, omega N, and phi N scattering, where B is the elastic slope parameter and sigma/sub t/ is the total cross section. This ratio increases slowly with energy, but remains the same in all channels. This is equivalent to a relation between the diffractive interaction radii and opacities; the opacity scales with the square of the radius. It is conjectured that this systematics extends to psi N scattering. B^2/sigma/sub t/ universality is contrasted with the slope predictions of an f-coupled pomeron model. Some other predictions of the f-dominance hypothesis are tested against data. (NL)

18650 ALTERNATIVE QUARK MODEL WITH CHARM. Goto, T.; Mathur, V. S. (Rochester Univ., N. Y. (USA). Dept of Physics and Astronomy). Phys. Lett., B; 59: No. 2, 153-156(27 Oct 1975).

A quark model is presented for SU(4) group, where the charged quark carries a charge Q equals $-\frac{1}{3}$. Various experimental consequences of this model are discussed and comparison with the model of Glashow et al. is made, especially with regard to the experimental features of the psi(3105) resonance. (NL)

18651 NUCLEON EXCHANGE: A SIMPLE DESCRIPTION. Gula, A.; Pennington, M. R. (Science Research Council, Chilton (UK). Rutherford Lab.). Nucl. Phys., B; 97: No. 3, 461-474 (20 Oct 1975).

It is shown that the high-energy behavior of exclusive and inclusive processes dominated by nucleon exchange can be described by simple form suggested by dual amplitudes. The energy, momentum transfer and mass dependences of the differential cross sections are reproduced. The value of the triple-Regge NNf coupling is obtained. The role of MacDowell partners and of exotic exchanges is discussed. (NL)

18652 QUARK PAIRS INSIDE HADRONS. Kleinert, H. (Institut fuer Theoretische Physik, Berlin, Germany). Phys. Lett., B; 59: No. 2, 163-167(27 Oct 1975).

Exact PCAC implies the presence of "wee" quark pairs inside any hadronic wave function. If present physics takes place underneath a large energy gap within a type-II superconductive world, such quark pairs find a natural quantitative explanation. It can be phrased in terms of a mixing operator which dresses any constituent quark wave function with the proper amount of pairs. This completes the program of transforming constituent quarks into current quarks (partons). (NL)

18653 SOLUTIONS OF CLASSICAL FIELD EQUATIONS WITH LOCALLY FINITE KINETIC ENERGY. Parenti, C. (Bologna Univ. (Italy)); Strocchi, F. (Scuola Normale Superiore, Pisa (Italy)); Velo, G. (Bologna Univ. (Italy). Istituto di Fisica). Phys. Lett., B; 59: No. 2, 157-158(27 Oct 1975).

Classical non-linear field equations are discussed in the space of functions having locally finite kinetic energy. An existence and uniqueness theorem for the Cauchy problem is presented. (NL)

18654 ASYMPTOTICALLY FREE SU(3) MODEL OF STRONG INTERACTIONS. Fradkin, E. S.; Kalashnikov, O. K. (AN SSSR, Moscow, Fizicheskij Inst.). Phys. Lett., B; 59: No. 2, 159-162 (27 Oct 1975).

An asymptotically free SU(3) model of strong interactions with massive vector fields is built. The fields are put into correspondence with the physical particles. The quark modification of this model is discussed also. (NL)

18655 TOPOLOGICAL EXPANSION FOR HIGH ENERGY HADRONIC COLLISIONS. I. General Properties and Connection with the Reggeon Calculus. Ciafaloni, M. (Scuola Normale Superiore, Pisa (Italy)); Marchesini, G. (European Organization for Nuclear Research, Geneva (Switzerland)); Veneziano, G. (Weizmann Inst. of Science, Rehovoth (Israel)). Nucl. Phys., B; 98: No. 3, 472-492(10 Nov 1975).

In this and in a companion paper a "topological expansion" for high-energy hadronic processes is proposed and discussed. In the first paper the general properties of the expansion and its connection with Gribov's reggeon calculus are presented. The topological expansion is first defined mathematically for a large class of theories and is shown to be equivalent to a "large-N expansion" in some theories which include planar dual models and non-Abelian gauge theories. Next, the definition of the bare parameters is given in terms of graphs on a sphere. The bare pomeron pole and its couplings are thus introduced. The (inclusive form of s-channel unitarity and its consequences for the above couplings are recalled. It is then shown how the expansion in the number of "handles" of the graph can be related to Gribov's reggeon calculus and how, with the aid of discontinuity equations in the J plane, scaling solutions can be obtained and critical indices can be computed to yield known results. (NL)

18656 TOPOLOGICAL EXPANSION FOR HIGH-ENERGY HADRONIC COLLISIONS. II. S-Channel Discontinuities and Multiparticle Content. Ciafaloni, M. (Scuola Normale Superiore, Pisa (Italy)); Marchesini, G. (European Organization for Nuclear Research, Geneva (Switzerland)); Veneziano, G. (Weizmann Inst. of Science, Rehovoth (Israel)). Nucl. Phys., B; 98: No. 3, 493-520(10 Nov 1975).

In a companion paper, the authors have defined a topological expansion for high-energy hadronic processes, and in particular discussed its asymptotic relation with reggeon field theory from a t-channel point of view. They turn to the study of s-channel unitarity which is automatically incorporated in the scheme. They first give a simple topological classification of s-channel discontinuities at high energies, for which some interference terms are argued to be negligible. They then find that the unitarity equation is decomposed in a sum of positive-definite terms related to various classes of events (generalized gap expansion). In the enhanced graph approximation they derive a cut reggeon field theory having three pomeron fields and four couplings, which is automatically consistent with the previous positivity requirements. Unitarity to all orders in 1/N (where U(N) is the internal symmetry group) constraints all couplings to be proportional, consistent (except for a possible ambiguity) with the cutting rules of Abramovskii et al. (NL)

18657 CUT CANCELLATION IN THE PLANAR INTEGRAL EQUATION FOR THE REGGEON. Bishari, M.; Veneziano, G. (Weizmann Inst. of Science, Rehovoth (Israel)). Phys. Lett., B; 58: No. 4, 445-448(29 Sep 1975).

Planar unitarity for the reggeon, analyticity and the multi-Regge assumption with cluster production lead to integral equations of the Chew–Goldberger–Low type with separable self-consistent kernel. Contrary to common prejudice, the authors show the existence of solutions exhibiting moving poles and exact, non-perturbative cancellation of the cut. Previously studied consistency conditions are rederived. (NL)

18658 ELASTIC SCATTERING IN PERTURBATION REGGEON CALCULUS. Capella, A.; Tran Thanh Van, J. (Paris-11 Univ., 91 - Orsay (France). Lab. de Physique Theorique et Particules Elementaires); Kaplan, J. (Paris-7 Univ., 75 (France)). Nucl. Phys., B; 97: No. 3, 493-512(20 Oct 1975).

A perturbative approach to the Reggeon calculus relevant at present is developed and applied to πN, KN and NN elastic scattering. In order to cover low and intermediate energies one has to introduce secondary Regge trajectories with a very large exchange degeneracy breaking. The total cross sections, the ratios of real over imaginary parts at t = 0 and the slopes of the differential cross sections from 10 GeV/c up to the highest ISR energies are correctly described. The intercept of the pomeron turns out to be $\alpha(0) = \sim 1.13$. (NL)

Strong (Baryon No. = 0)

18659 FACTORIZATION OF REGGE-CUT DISCONTINUITIES. Joshi, G. C. (Univ., of Melbourne, Parville, Australia). Lett. Nuovo Cim.; 13: No. 18, 680-682(30 Aug 1975).

The factorization properties of cuts in the l-plance are studied using unitarity and analyticity. The unitarity equations are used in the zero-mass limit. The discussion is started with a two-channel system with Froissart–Gribov representations for $\pi\pi \to \pi\pi$, $\pi\pi \to K\bar{K}$ and $K\bar{K} \to K\bar{K}$. Conditions are derived under which a moving branch cut discontinuity may factorize at isolated points. It appears that a certain class of cuts may factorize at t = 0 leading to a factorization equation for the total cross section and $(d\sigma/dt)_{t=0}$. In any case cuts cannot factorize for t < 0 as a consequence of unitarity. (JFP)

18660 TIME EVOLUTION OF QUASI-STATIONARY STATES. Razavy, M. (Alberta Univ., Edmonton). Int. J. Theor. Phys.; 13: No. 4, 237-257(Jul 1975).

The time evolution of prepared states in some quantum mechanical models is studied, and the probability of decay and the rate

of energy dissipation and their dependence on the form of the interaction are discussed. First solvable models with divergent matrix elements for the operator H^2, where H is the Hamiltonian of the system, are considered. Two specific examples are studied, one with well defined eigenvalues and the other with renormalizable interaction. The time development of the initial state in the latter case depends on the cut-off parameter. The possibility is shown of the existence of decaying states with long lifetime, where the amplitude of the initial state decreases like a Bessel function. The time development of a prepared state in a simple many-boson problem is determined. Finally the problem of penetration of a wave packet through two phase-equivalent potential barriers is studied, and it is concluded that from the scattering phase shifts alone, it is not possible to determine the lifetime or the mode of decay of an unstable particle uniquely. (auth)

18661 DETERMINATION OF SPIN–PARITY OF ELEMENTARY PARTICLES PRODUCED IN COLLISIONS OF POLARIZED PARTICLES. Klosinski, J.; Kosinski, P.; Tybor, W. (Lodz Univ., Poland). Ann. Phys. (Leipzig); 32: No. 4, 242-248(Jun 1975).

Peshkin's "maximum complexity method" is adopted for reactions $0 + \frac{1}{2} \rightarrow j + s$, $\gamma + 0 \rightarrow j + 0$ with polarized initial particles. The produced particles undergo the decays $s \rightarrow 0 + \frac{1}{2}$, and j decays strongly into 0 + 0 + 0. Study of certain correlations in such processes allows one to determine the spins of the produced particles. Because the spin of the X^0 (960) meson is not firmly established one applies the general results obtained to the reactions: $K^-p \rightarrow X^0\Lambda$, $\pi p \rightarrow X^0N^*$, $\gamma He \rightarrow X^0He$. (auth)

18662 Ψ-RESONANCES, GLUONS, AND THE ZWEIG RULE. Fritzsch, H.; Minkowski, P. (California Inst. of Tech., Pasadena). Nuovo Cim.; 30A: No. 3, 393-429(1 Dec 1975).

On the basis of the quark-gluon field theory the dynamical manifestations of gluons is discussed in hadron physics. The Zweig rule for meson decays and the decays of the Ψ-resonances are considered. Depending on the various possibilities for the spectrum of the glue mesons, both the glue annihilation and the mixing mechanism for the Zweig-rule-violating meson decays are discussed. Depending on the various possibilities for the spectrum of the glue mesons, both the glue annihilation and the mixing mechanism for the Zweig-rule-violating meson decays are discussed. Furthermore one discusses the break-down of PCAC for the pseudoscalar analog of the Ψ-meson and the importance of the glue mixing term for the mass spectrum of the pseudoscalar mesons. (auth)

18663 ELECTROMAGNETIC EFFECTS IN DIFFRACTIONAL SCATTERING OF HADRONS. Kopeliovich, B. Z.; Lapidus, L. I.; Frankfurt, L. L.; Khoze, V. A. (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 2, 422-428(Aug 1975). (In Russian)

The role of electromagnetic effects in diffraction processes is discussed for the cases of strong and weak pomeron interactions. Interference diagrams with γ quantum and $\tilde{V}$ meson exchange are found to result in a shift of the vacuum pole by $\Delta^{IV} \sim 10^{-3}$. A correction to the three-pomeron coupling constant also arises; it is related by a simple equation to Δ^{IV}. The correction comprises several percent of the experimental value. It is shown that in the case of strong coupling the contributions of the two effects to the vacuum pole position may be compensated. On the other hand purely electromagnetic corrections always evoke a shift of the pole to the right of unity. (auth)

18664 P-WAVE UNITARIZED $\pi\pi$ SCATTERING AMPLITUDE WITH VENEZIANO AND POMERON INPUT. Stihi, M.; Visinescu, A. (Inst. for Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 6, 585-592(1975).

It is shown that unitary P-wave amplitude for $\pi\pi$ scattering exhibiting resonances can be constructed when a Veneziano left-hand cut discontinuity and a Pomeron contribution are taken as input. Moreover, it is even possible to look for a bootstrapped solution giving the mass and width of a resonance which could be the ρ-meson. (auth)

18665 ADAIR DISTRIBUTION FOR X^0 (960)-MESON PHOTOPRODUCTION ON ^{4}He NUCLEUS. Genina, L. E.; Zaslavskii, A. N. (Erevan Inst. of Physics). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 5, 354-362(1974). (In Russian)

Correlations between decay modes and the production of the X^0 (960)-meson in the reaction $\gamma + {}^4He \rightarrow X^0 + {}^4He$ are considered. Adair distributions allow one to distinguish between the hypotheses of $J^P(X^0) = 2^-$ and 0^-. (auth)

18666 A T-CHANNEL ISOSPIN ANALYSIS OF THE CHEW–LOW PLOT FOR $\bar{N}N \rightarrow \bar{N}(N\pi)$ INTERACTIONS AT 5.7 GeV/c. Strachman, Z. (Lab. de Physique Nucleaire et Hautes Energies, Universite Pierre et Marie Curie, Paris, France); Braun, H.; Gerber, J. P.; Maurer, G.; Michalon, A.; Schiby, B.; Strub, R. (Strasbourg-1 Univ., 67 (France)). Nucl. Phys., B; 98: No. 1, 120-136(27 Oct 1975).

A new approach to the t-channel isospin analysis of $ZN \rightarrow Z'(N\pi)$ reactions is presented. This approach, useful for Z = N, $\bar{N}$, K^- when only five independent sets of data are available, is used to analyze data of $\bar{N}N \rightarrow \bar{N}(N\pi)$ reactions in an $\bar{p}p \rightarrow \bar{N}N\pi$ experiment at 5.7 GeV/c and an $\bar{p}d \rightarrow \bar{N}N\pi p_S$ experiment at 5.5 GeV/c. The t behavior of the different isospin exchange amplitudes suggests their exchange mechanism production. The mass spectrum $M_{\pi N}$, of the contributions produced by exchange isospin $I_{ex} = 1$, shows enhancements corresponding to N(1490), N(1670) and Δ(1230) isobars; while the mass spectrum for $I_{ex} = 0$ presents only a large bump at approximately 1350 MeV, commonly identified as $N^*(1400)$. (NL)

18667 $\bar{p}p$ PARTIAL-WAVES ANALYSIS AT 400 AND 500 MeV/c. Aloum, M. L. (College de France, 75 - Paris). Phys. Lett., B; 58: No. 4, 491-494(29 Sep 1975).

A partial-waves analysis of the $\bar{p}p$ elastic scattering, at fixed momenta 400 and 500 MeV/c (lab.), has been performed. It is mainly assumed that most of the amplitude comes from orbital momenta $l \leq 2$. Although polarization values are lacking, adjustment to available experimental data leads to a restricted number of solutions, because of strong unitarity constraints. (NL)

18668 POSSIBLE EFFECTS OF DECAYS OF CHARMED-PARTICLE RESONANCES. Nussinov, S. (Institute for Advanced Study, Princeton, New Jersey 08540). Phys. Rev. Lett. 35: No. 24, 1672-1675 (15 Dec 1975).

Under the assumption that production of the charmed vector meson D^* is important in the charm threshold region, the soft cascade pion (photon) from $D^* \rightarrow D\pi$ ($D^* \rightarrow D\gamma$) for $M_{D^*} - M_D > M_\pi (M_{D^*} - M_D < M_\pi)$ could serve as a very useful clue for charmed particles. Also the pions produced in e^+e^- collisions together with (strong-interaction-stable) charmed particles must obey energy equipartition. This strongly suggests other new heavy-quark thresholds and/or heavy-lepton production. (auth)

18669 FINE-STRUCTURE CORRECTIONS AND ELECTROMAGNETIC DECAYS OF CHARMONIUM. Pumplin, J.; Repko, W.; Sato, A. (Department of Physics, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. Lett. 35: No. 22, 1538-1540 (1 Dec 1975).

We calculate fine-structure corrections to the spectrum of ψ/J particles in the charmonium model, assuming that the linear potential which confines the quarks is due to an effective vector exchange. We also calculate the electromagnetic decay rates between the various low-lying s and p states. (auth)

18670 LINEAR REGGE TRAJECTORIES FOR THE PSION FAMILY AND O(4) DYNAMICS. Chang, N. (Physics Department, City College of the City University of New York, New York, New York 10031); Nelson, C.A. Phys. Rev. Lett. 35: No. 22, 1492-1495 (1 Dec 1975).

The newly discovered psion family can be described by mass-squared linear Regge trajectories. The new J^{PC} assignments are for 2.8 GeV/c^2, 0^{++}, and for the 3.4 region, 2^{++}, 1^{-+}, 0^{++}. All radiative decays are related through a single $S_{\mu\nu}F_{\mu\nu}$ coupling. A good fit is obtained. (auth)

18671 NONSPHERICAL DEFORMATIONS OF HADRONIC BAGS. Rebbi, C. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Rev. D 12: No. 8, 2407-2421 (15 Oct 1975).

A Hamiltonian formalism is developed to describe the classical motion of a bag-type model for small oscillations of the boundary around a static configuration and to give an approximate quantization of the system. It is shown that in the case of the one-dimensional bag the method reproduces the exact form of the mass-squared operator, which is known from the light-cone quantization. The formalism is then applied to the study of a three-dimensional bosonic bag and in particular to the analysis of the P-wave excitations. (auth)

18672 GENERALIZED NUTBROWN REPRESENTATION OF THE VECTOR VERTEX FUNCTION AND THE MAGNETIC MOMENT OF THE CHARGED ρ MESON. Glück, M. (Institut für Physik der Johannes Gutenberg-Universität, Mainz, West Germany). Phys. Rev. D 12: No. 8, 2482-2485 (15 Oct 1975).

A former representation of the vector vertex function, due to Nutbrown, is generalized. It is shown how this resolves an apparent contradiction between the effective-Lagrangian and hard-meson techniques. Further possible applications are discussed. (auth)

18673 HEAVY-VECTOR-MESON DOMINANCE. Walsh, T. F. (Deutsches Elektronen-Synchrotron, Hamburg). Lett. Nuovo Cim.; 14: No. 8, 290-294(25 Oct 1975).

The concept of vector meson dominance is extended to the recently discovered heavy mesons. The main assumption is the approximate constancy of vector meson–hadron amplitudes for $0 \leq Q^2 \leq M^2$ or in dispersion theory language, and the absence of significant continuum (nonpole) contributions in the current channel. (JFP)

Strong (Baryon No. = 1)

Refer also to abstract 19142.

18674 RELATION BETWEEN π–p AND p–p SCATTERINGS. Susuki, Y.; Yonezawa, M. (Hiroshima Univ.). Lett. Nuovo Cim.; 14: No. 8, 267-270(25 Oct 1975).

The total and differential cross sections are found for πp and pp and their structure compared. Also the coupling constant ratio between pp and πp interactions is found. (JFP)

18675 ROLE OF ENERGETICALLY DISTINGUISHED PARTICLES IN PION–NUCLEON INTERACTIONS. Gaitinov, A. Sh.; Takibaev, Zh. S.; Chasnikov, I. Ya.; (Inst. of Nuclear Physics, Alma-Ata, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 9, 1677-1679(Sep 1970).

From all-union conference on cosmic ray physics; Leningrad, USSR (9 Oct 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 9, 1885-1887.

An attempt is made to interpret the role of the energetically distinguished particles and their effect on the characteristics of the secondary pions in inelastic π^-p interactions at 10.2 GeV. (JFP)

18676 HADRON AND ITS CONSTITUENTS. Faiman, D. (Weizmann Inst. of Science, Rehovoth, Israel). Nuovo Cim.; 30A: No. 3, 498-504(1 Dec 1975).

It is argued that most of the experimental observations concerning $\Sigma(1750, 1/2^-)$ are understandable if to first approximation this resonance decouples from the $\Sigma\pi$ and $\Lambda\pi$ channels. A rather widespread correlation between mixing angles and decoupled channels is pointed out, and one speculates on its significance for a deeper understanding of the hadron masses. (auth)

18677 NON-REGGE AND HYPER-REGGE EFFECTS IN PION–NUCLEON CHARGE EXCHANGE SCATTERING AT HIGH ENERGIES. Joynson, D. (Institut de Physique Nucleaire, Paris); Leader, E.; Nicolescu, B.; Lopez, C. Nuovo Cim.; 30A: No. 3, 345-384(1 Dec 1975).

The experimental data on the charge exchange differential cross section and on the difference of the π^+p and π^-p total cross sections in the range $p_L = 5$ GeV/c to 200 GeV/c are shown to be incompatible with conventional Regge asymptotic behavior. It is shown that an additional term is required which grows in importance with energy. The precise form of the new term cannot be ascertained, but it is shown that it corresponds to a singularity at $J = 1$ in the complex-angular-momentum plane. Amongst the possible types of additional term there are two which are aesthetically favored and which have been closely analyzed. These correspond to a non-Regge behavior associated with the maximal growth permitted in axiomatic field theory; a "hyper-Regge" term, i.e., and odd-signatured Regge pole, the analog of the pomeron pole, with intercept $\alpha = 1$ at $t = 0$. Very striking predictions, in particular for the charge exchange polarization, follow as a consequence of the non-Regge or hyper-Regge asymptotic behavior of the crossing-odd amplitude. (auth)

18678 πp ELASTIC SCATTERING AND PERIPHERAL REACTIONS. **Yokosawa, A. (High Energy Physics Division, Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. Lett. 35: No. 25, 1738-1739 (22 Dec 1975).**

We show that πp charge exchange and πp backward elastic scattering at intermediate energies are peripheral reactions. The backward scattering at high energies, say 6 GeV/c, has not been successfully interpreted in terms of baryon-exchange processes. We present a new way to study the backward scattering. (auth)

18679 BACKWARD MESON–BARYON SCATTERING AND GEOMETRICAL PROPERTIES OF BARYONIC EXCHANGES. Ader, J. P. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Phys., B; 98: No. 1, 154-172(27 Oct 1975).

On the basis of the "b universality" hypothesis, Regge behavior and SU'3' symmetry, processes of the type $0^- \frac{1}{2}^+ \to 0^- \frac{1}{2}^+$ at backward angles when significant data are available are discussed. Related annihilation processes by line-reversal are also studied and duality constraints are taken into account. On the whole a satisfactory scheme seems to emerge. (NL)

18680 CLUSTER PRODUCTION AND THE POMERON IN MESON–BARYON AND BARYON–BARYON COLLISIONS. Webber, D. M. (Eidgenoessische Technische Hochschule, Zurich (Switzerland)). Phys. Lett., B; 58: No. 4, 459-462 (29 Sep 1975).

The bare pomeron in models based on duality diagrams is found to contribute very differently at low energies to pp and Kp total cross sections. A simple quantitative comparison of these cross sections is found to be consistent with phenomenological cluster production models. (NL)

Strong (Baryon No. ≥ 2)

Refer also to abstracts 19138, 19140, and 19195.

18681 (CEA-CR-2, pp 123-132) SPECULATIONS ON COLLISIONS OF VERY HIGH ENERGY PARTICLES WITH NUCLEI. Czyz, W. [nd].

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8-10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

It is shown that many strange phenomena recently discovered reflect the same origin as the short-time behavior of production processes, namely strong suppression of interactions of newly born hadrons. A definite algorithm is proposed to describe such processes and to compute their various characteristics. This algorithm assumes the existence of a leading particle which acts as a source for the particles produced. The essential feature of this approach is the unitarity of all individual S matrices. Once a model has been chosen for the elementary processes, very definite predictions can be made. An example of the hadronic Bremsstrahlung model of the elementary process is briefly discussed. (FR)

18682 (IPNO-TH-75-09) A NEW SEMIPHENOMENOLOGICAL SOFT CORE AND VELOCITY DEPENDENT NUCLEON-NUCLEON POTENTIAL. Lacombe, M.; Loiseau, B.; Richard, J. M.; Vinh Mau, R.; Pires, P.; de Tourreil, R. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire). 1975. 11p. INIS.

A nucleon-nucleon potential is constructed which possesses a fundamental theoretical long and medium range part. The short range part is determined phenomenologically by fitting the phase parameters as well as the deuteron properties. Although the number of free parameters is small (six in each isospin state) the quality of the fit is very good. (FR)

18683 INVARIANT VARIABLES ATTACHED TO FOUR-PARTICLE GROUPS. Laurikainen, K. V. (Helsinki Univ.); Mihul, E. A. Nuovo Cim.; 28A: No. 2, 129-136(21 Jul 1975).

Mathematical reasons motivate the use of the determinant set $\{p_i^\nu\}$ of the components of four 4-momenta as an invariant, pseudoscalar variable in many-particle processes. The properties of this variable are discussed and some examples of its behavior in experimental processes are given. (auth)

18684 HIGH-ENERGY SCATTERINGS IN QUANTUM FIELD THEORY. Phat, T. H. (Inst. of Theoretical Physics, Warsaw); Nuovo Cim.; 28A: No. 3, 364-382(1 Aug 1975).

On the basis of the general principles of quantum field theory, renormalization group approach and two additional assumptions, the asymptotic behaviors of the proton-proton scattering amplitude are studied in different asymptotic regions. It is shown that the Regge behavior is possible in some cases and impossible in others. It all depends on how the invariant coupling constant $\bar{g}(\tau)$ tends to the limit value as $\tau \to +\infty$. In the case when the Regge behavior takes place, the values of Regge-trajectory function and Regge cut at $\tau = -\infty$ are defined by the characteristics of the renormalization group. The possible large-t scaling of the scattering amplitude and the light-cone singularities are also considered and discussed. (auth)

18685 NEUTRON-PROTON CHARGE EXCHANGE AT HIGH ENERGIES. A Crucial Reaction. Diu, B. (Univ., Paris); Leader, E. Nuovo Cim.; 28A: No. 2, 137-154(21 Jul 1975).

The shape of the np → pn $d\sigma/dt$ is extraordinarily independent of energy throughout the range $1.5 \lesssim p_L \lesssim 25$ GeV/c, despite the expected competition between π exchange with its associated background and ρ, A_2 exchange. An analysis of this situation predicts a radical change beyond $p_L = 40$ GeV/c if standard ideas about particle exchange are at all meaningful. It is also shown that the significant difference found at FNAL between the pp and pn total cross sections, which probably indicates a break-down of Regge asymptotics, will strongly influence the np → pn reaction. Measurements of high-energy np charge exchange will therefore provide a crucial test for current theoretical ideas. (auth)

18686 EFFECTS OF INELASTIC p-AIR CROSS SECTION, THE FEYNMAN SCALING HYPOTHESIS AND THE PRIMARY

COMPOSITION ON THE MAXIMUM DEPTH. Bordeau, M. F.; Capdevielle, J. N.; Procureur, J. (Univ., Bordeaux). J. Phys., G (London); 1: No. 8, 821-835(21 Oct 1975).

Simulations of extensive air showers for several models of ultra-high energy interactions, involving isobar production and ψ production, are carried out with energy-dependent cross sections. The sensitivity of the maximum depth to power or logarithmic multiplicity laws for secondaries and to scaling models is discussed together with the effect of the cross section and the chemical composition of the primary cosmic component. Agreement with experimental data on the maximum depth is obtained without requiring such an important multiple production as $E^{\frac{1}{4}}$. (auth)

18687 AZIMUTHAL, ANGULAR CHARACTERISTICS OF SECONDARY PARTICLES IN PROTON–NUCLEON AND PION–NUCLEON INTERACTIONS AT ACCELERATOR ENERGIES. Azimov, S. A.; BonDarenko, A. I.; Gulamov, K. G.; Navotnyi, V. Sh.; Petrov, V. I.; Riskiev, T. T.; Trofimova, T. P.; Chernova, L. P.; Chernov, G. M. (Physical-Technical Inst., Tashkent). Izv. Akad. Nauk Uzb. SSR, Ser. Fiz.-Mat. Nauk; No. 1, 84-90 (1975). (In Russian)

This study describes a general method of analyzing azimuthal angular distributions during multiple particle generation, that takes into account quantitatively the effect of the law of conservation of energy and momentum. Azimuthal distributions are analyzed in proton-nucleon collisions at p_0 = 21, 50, 67 and 200 Gev/c, and in pion-nucleon collisions at p_0 = 45 Gev/c. It is shown that azimuthal effects do not depend on energy, and are described by a simple model which takes into account only kinematic factors. These data contradict the characteristic correlations predicted by the multiperipheral model. (tr-SJR)

18688 DIFFRACTIVE CONTRIBUTION TO THE SINGLE-PARTICLE INCLUSIVE NEUTRON SPECTRUM IN pp COLLISIONS THROUGH LOW-MASS RESONANCE DECAY. Ferrari, E. (Rome Univ. (Italy). Istituto di Fisica). Nucl. Phys., B; 98: No. 1, 109-119(27 Oct 1975).

The contribution of the two-step reaction, consisting in diffractive production of the N*(1470) resonance and its decay into a neutron, to the inclusive neutron spectrum in pp collisions is studied in detail. It is found that, at low $p_\perp$ and near x = 1, the effect gives rise to a peak, which, in principle, can be detected in experiments with a good momentum resolution. (NL)

18689 VECTOR MESON AND ψ CONTRIBUTIONS TO SINGLE LEPTON SPECTRA. Bourquin, M. (Geneva Univ. (Switzerland)); Gaillard, J. M. (European Organization for Nuclear Research, Geneva (Switzerland)). Phys. Lett., B; 59: No. 2, 191-196(27 Oct 1975).

The data on the dilepton spectra in a forward cone are used to predict the ρ^0, ω^0, and ψ production at $\theta_{c.m.}$ approximately 90^0 and their contributions to the single lepton spectra. The π, $(\rho^0 + \omega^0)$, and ψ inclusive cross sections are well fitted over the entire p_T range by a simple expression. Combined contributions from ρ^0, ω^0, and ψ are found to account for about 30% of the observed lepton spectra. The contribution from the dilepton continuum is also discussed. (NL)

18690 COMMENT ON THREE-PARTICLE MODEL OF THE *NNπ* SYSTEM. Fuda, M.G. (Department of Physics and Astronomy, State University of New York at Buffalo, Buffalo, New York 14214). Phys. Rev. C 12: No. 6, 2097-2099 (Dec 1975).

It is shown that the one pion exchange interaction that arises in the Afnan-Thomas model of the *NNπ* system has unphysical matrix elements which connect spin singlet and spin triplet states of the two nucleon system. The unphysical coupling arises only between singlet and triplet states for which the orbital angular momentum is equal to the total angular momentum. This coupling vanishes in the static limit. (auth)

18691 *T* ASYMMETRY IN THE STRONG INTERACTION AT MEDIUM ENERGIES. Bryan, R.A. (Center for Particle Theory, University of Texas at Austin, Austin, Texas 78712 and Research Institute for Theoretical Physics, University of Helsinki, Siltavuorenpenger 20, SF-00170 Helsinki 17, Finland). Phys. Rev. C 12: No. 6, 1968-1973 (Dec 1975).

We examine current intermediate-energy nucleon-nucleon data sensitive to *T* asymmetry and conclude that of these data, some *np* polarization and asymmetry measurements give the best evidence that *T* is good, despite the fact that these data have the largest errors of any of the data considered. This conclusion is reached using a one-boson-exchange potential due to Bryan and Gersten, wherein *T* is violated at short distances. We argue that any short-range *T*-asymmetric model would probably lead to the same conculsion. We show that the current *N-N* data admit the possibility of *strong*-interaction *T* asymmetry, so long as it be of short range. For experimentalists who may search for strong-interaction *T* violation in intermediate energy *N-N* scattering, we suggest maximum errors for several measurements so that any such *T* violation may not be missed. (auth)

18692 IMPLICATIONS OF HIGH ENERGY PION-NUCLEON SCATTERING DATA FOR PION-NUCLEUS SCATTERING. Ernst, D.J. (Department of Physics, Case Western Reserve University, Cleveland, Ohio 44106); Miller, G.A. Phys. Rev. C 12: No. 6, 1962-1967 (Dec 1975).

Energy-dependent separable potentials are generated by solving the inverse problem for three sets of pion-nucleon phase shifts which differ only at very high (E_{lab} > 1900 MeV) energies. While the off-shell *t* matrices thus generated have substantial differences, these effects are small for π-nucleus cross sections as calculated within the impulse approximation. (auth)

Particle Invariance Principles and Symmetries

Refer also to abstracts 19321 and 19347.

General

Refer also to abstracts 18700 and 19320.

18693 INTRINSIC EXCLUSION PRINCIPLE AND FERMI–BOSE SUPERGROUP. Krolikowski, W. (Univ., Kaiserlautern, Ger.). Bull. Acad. Pol. Sci., Ser. Sci. Math. Astron. Phys.; 23: No. 7, 811-814(1975).

It is pointed out that the Fermi–Bose supergroup of Wess and Zumino is closely related to the idea of the intrinsic exclusion principle discussed several years ago. This relation emphasizes the "intrinsic" character of "quarks" created by spinor generators of the supergroup in the rest system of reference. The supergroup-like theory in its present state does not reproduce, however, the "symmetric-quark-model" results which are consistent with the experimental hadron spectroscopy. (auth)

Applications (Electromagnetic and Weak)

Refer also to abstracts 18479 and 18634.

18694 SU(2) × SU(2) GROUP BASED MODEL OF WEAK AND ELECTROMAGNETIC INTERACTIONS OF LEPTONS. Asratyan, A. E. (Inst. of Physical Research, Erevan). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 9: No. 5, 347-353(1974). (In Russian).

The SU(2) × SU(2) group based gauge model of weak and electromagnetic interactions of leptons is proposed. Right- and left-polarized leptons enter the model symmetrically; μ^+-meson and electron are included in the same irreducible multiplet. Besides the photon and the heavy charged vector boson responsible for the observed weak processes, the model incorporates a neutral vector boson and a superheavy charged vector boson. (auth)

18695 VANISHING CABIBBO ANGLE AND MUON CAPTURE RATES. Watson, P. J. S. (Carleton Univ., Ottawa, Ontario (Canada). Dept. of Physics). Phys. Lett., B; 58: No. 4, 431-432 (29 Sep 1975).

Recent papers have discussed the possibility that a spontaneously broken symmetry is restored at high magnetic fields. Possible evidence in favour of this idea is noted. (NL)

18696 GAUGE MODEL OF WEAK AND ELECTROMAGNETIC INTERACTIONS WITH CHARM VIOLATING TRANSITIONS. Incoul, R.; Nuyts, J. (Mons Univ. (Belgium)). Nucl. Phys., B; 98: No. 3, 429-446(10 Nov 1975).

Extending the usual SU(2) × U(1) group of weak and electromagnetic interactions into a larger SU(2) × U(1) × U(1) group, it is shown that the extra freedon provided by the new generator allows a new neutral charm-violating transition. Indeed, apart from the two charged currents and the electromagnetic one, there exist two neutral weak currents coupled to two distinct intermediate neutral bosons. (NL)

Applications (Strong)

18697 CHIRAL-SYMMETRY BREAKING AND THE AMBIGUITY OF ALTERNATIVE SOFT-PION APPROACHES TO THRESHOLD $\pi N \to \pi\pi N$. Rockmore, R. (Department of Physics and Cyclotron Laboratory, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. Lett. 35: No. 21, 1408-1411 (24 Nov 1975).

The alternative soft-pion approaches to threshold $\pi N \to \pi\pi N$ provided by the phenomenological-Lagrangian and current-commutator theories

are shown to differ only in their pion-pole contributions. Since the data for the reaction $\pi^- p \to \pi^- \pi^+ n$ seem well fitted by the former theory for $\xi = 0$, and by the latter for $\xi = -1/2$, where ξ is the chiral-symmetry-breaking parameter introduced by Olsson and Turner, threshold total-cross-section data for this charge state will not be able to determine a unique ξ value. (auth)

Scattering Theory

Refer also to abstracts 18798, 19329, and 19351.

18698 (ITP-75-80E) CENTRAL DIFFRACTIVE PRODUCTION IN THE DUAL ANALYTIC MODEL FOR MULTIPLE POMERON. Kobylinsky, N. A.; Martynov, E. S. (AN Ukrainskoj SSR, Kiev. Inst. Teoreticheskoj Fiziki). 1975. 27p. Dep. NTIS (US Sales Only) $4.00.

The previously suggested dual analytic model for multiple pomeron is further investigated. The central diffractive production cross sections are calculated on the basis of the eight-point model amplitude having simple and double P-poles in five vacuum channels. It is shown that the total cross section behavior of the process under consideration depends on the structure of corresponding diagram, that is, on the number of simple and double P-poles and their position in the diagram. The relation between the rise of nondiffractive and diffractive terms of the total cross sections is discussed for different types of simple and double P-pole couplings. (auth)

18699 MULTIPLE EXCHANGE AND HIGH-ENERGY FIXED-ANGLE SCATTERING. Halliday, I. G. (CERN, Geneva); Orzalsi, C. A.; Neri, F.; Tau, M. Lett. Nuovo Cim.; 14: No. 8, 280-282(25 Oct 1975).

Recently the leading high energy fixed-angle behavior of the elastic scattering amplitude was calculated to order g^4. It was concluded that the Schiff eikonal approximation gives the wrong answer, contrary to the results of previous work. It is shown that the results of the former arguments are incomplete and that the true result confirms that of the questioned previous work. (JFP)

18700 POMERANCHUK POLE AS A GOLDSTONE BOSON. Dyatlov, I. T. (Leningrad Inst. of Nuclear Physics). Zh. Eksp. Teor. Fiz.; 69: No. 4, 1127-1140(Oct 1975). (In Russian)

The Pomeranchuk pole is considered as appearing as the result of spontaneous violation of continuous symmetry of a set of Regge poles in the vacuum channel. An interpretation is presented of the appearance of spontaneous violation for reggeons. The symmetry group choice involves in a natural way a second vacuum pole P′ displaced from $j = 1$ and possessing an α' differing from that of the pomeron. Possible interactions for P and P′ are found with an accuracy to squares of the reggeon momenta k_i. They lead to a quasi-stable pomeron, as in the model of a weak coupling pomeron. (auth)

18701 BELL's THEOREM AND WORLD PROCESS. Stapp, H. P. (Univ. of California, Berkeley). Nuovo Cim.; 29B: No. 2, 270-276(11 Oct 1975).

The noncausal structure events demanded by Bell's theorem are shown to follow naturally from a theory of events similar to Whitehead's. In spite of this noncausal structure on the level of individual events the macroscopic causality structure observed in nature at the statistical level holds. Quantum theory itself emerges naturally, along with the basic analyticity property of the S-matrix. (auth)

18702 ARE THE ρ- AND A_2-TRAJECTORIES LINEAR. Bugrij, A. I. (Institut fuer Hochenergiephysik, Berlin); Kobylinskii, N. A. Ann. Phys. (Leipzig); 32: No. 4, 297-303(Jun 1975).

An analysis is given of to what extent the rise of the real part of Regge trajectories is due to contributions from baryon-antibaryon thresholds and to what extent it is connected with the presence of a linear term. It is shown that sewing the trajectory from the scattering to the resonance region results in "switching off" the linear term; the remaining contributions of various thresholds guarantee the necessary linearity of the trajectories. (auth)

18703 INTEGRAL REPRESENTATION FOR SCATTERING AMPLITUDE RELATED TO THE DE SITTER GROUP. Kachurik, I. I.; Khimich, I. V. (Uzhgorod State Univ., USSR). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 8, 1251-1262(Aug 1975). (In Russian)

The basis functions on the cone which realize the principal series unitary irreducible representations of the homogeneous de Sitter group were plotted. The decomposition of a scalar scattering amplitude outside the mass shell being considered as a function on the cone was performed in these function terms. The asymptotic integral representation of the scattering amplitude on the mass shell is also discussed. (auth)

18704 ITERATIVE SOLUTION OF THE PARTIAL-WAVE SCATTERING PROBLEM. Stihi, M. (Inst. for Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 6, 565-584(1975).

A convergent iterative procedure for solving the relativistic partial wave scattering problem, based on Laplace transforms is developed. Approximate solutions which satisfy the exact unitarity relation can be obtained. (auth)

18705 EIKONAL APPROXIMATION IN THE THREE-PARTICLE RELATIVISTIC SYSTEM. Begeluri, G. A.; Kvinikhidze, A. N. (Inst. of Mathematics, Tbilisi, USSR). Soobshch. Akad. Nauk Gruz. SSR; 79: No. 2, 343-348(Aug 1975). (In Russian)

A closed expression for the relativistic three-particle elastic scattering amplitude in the eikonal approximation is obtained. (auth)

18706 CANTERBURY APPROXIMANTS IN POTENTIAL SCATTERING. Graves-Morris, P. R.; Samwell, C. J. (Kent Univ., Canterbury, Eng.). J. Phys., G (London); 1: No. 8, 805-814(21 Oct 1975).

It is shown, by examples, that two variable rational approximant schemes previously devised are quite satisfactory for obtaining amplitudes from a two variable Neumann-Born series. It is found that the [N + 1/N] and [N/N] are markedly the best approximants in this context, and attention is drawn to the numerical accuracy in the Neumann-Born series coefficients which is essential in conjunction with Pade-type approximants. (auth)

18707 AMBIGUOUS SETS OF PARTIAL-WAVE AMPLITUDES CANNOT INTERSECT. Dean, N. W. (Ames Lab., Iowa (USA)). Nucl. Phys., B; 97: No. 3, 377-380(20 Oct 1975).

The correct set of partial-wave amplitudes can sometimes be distinguished from ambiguous ones because it joins continuously, as a function of energy, to a lower-energy set known unambiguously. If two sets intersect, however, this continuity criterion yields no unique answer. It is shown that such an intersection is in fact impossible in the usual experimental spin-0–spin-$^1/_2$ scattering situation. (NL)

18708 PHASE SHIFTS DUE TO A MIXTURE OF LONG- AND SHORT-RANGE POTENTIALS. Wald, S.S.; Schardt, M.; Lu, P. (Department of Physics, Arizona State University, Tempe, Arizona 85281). Phys. Rev. D 12: No. 8, 2244-2248 (15 Oct 1975).

We show that the generalized or modified WKB method can be readily applied to a mixture of long- and short-range potentials. The phase shifts of such a mixed potential are calculated to order $\hbar^2$ by using the solutions of the long-range potential as the bases of the approximation and treating the differences between the long-range and mixed potential as a WKB perturbation. We demonstrate the method by a simple example using a Coulomb and inverse-square potential. Comparison of the phase shifts with the exact results shows excellent agreement. The phase shifts can then be separated into contributions due to the long-range and short-range potentials plus a contribution due to the mixture or coupling of the potentials. For small angular momenta, the contribution due to coupling is of the same order of magnitude as the Coulomb contribution, but rapidly decreases with higher angular momentum. (auth)

18709 REGGEON FIELD THEORY ON A LATTICE. Cardy, J.L.; Sugar, R.L. (Department of Physics, University of California, Santa Barbara, California 93106). Phys. Rev. D 12: No. 8, 2514-2522 (15 Oct 1975).

We construct an analog model of interacting Ising spins on a lattice which has the same critical behavior as Reggeon field theory, in the physical number of dimensions. At the critical point the total and elastic cross sections have asymptotic behaviors $\sigma_{\text{tot}} \propto (\ln s)^{-\gamma}$ and $\sigma_{\text{el}} \propto (\ln s)^{-2\gamma - z}$. By studying the properties of the fixed point of an explicit nonlinear renormalization-group transformation on the lattice, we show that $-\gamma \leq z \leq 2$, so that both the Froissart bound and the constraint $\sigma_{\text{el}} < \sigma_{\text{tot}}$ are satisfied. (auth)

18710 PATH-INTEGRAL FORMULATION OF SCATTERING THEORY. Campbell, W.B. (Kellogg Radiation Laboratory, California Institute of Technology, Pasadena, California 91125); Finkler, P.; Jones, C.E.; Misheloff, M.N. Phys. Rev. D 12: No. 8, 2363-2369 (15 Oct 1975).

A new formulation of nonrelativistic scattering theory is developed which expresses the S matrix as a path integral. This formulation appears to have at least two advantages: (1) A closed formula is obtained for the S matrix in terms of the potential, not involving a series expansion; (2) the energy-conserving δ function can be explicitly extracted using a technique analogous to that of Faddeev and Popov, thereby yielding a closed path-integral expression for the T matrix. The introduction of the concept of the classical interaction picture provides

considerable physical insight into this formulation. This formulation also suggests a succession of improvements to the eikonal approximation, the first of which is discussed explicitly. (auth)

18711 REPRESENTATIONS OF REGGEON GREEN'S FUNCTIONS: THEIR SCALING FORM AND THE APPROACH TO SCALING. Frazer, W.R.; Moshe, M. (Department of Physics, University of California, San Diego, La Jolla, California 92037). Phys. Rev. D 12: No. 8, 2370-2384 (15 Oct 1975).

We derive representations for Green's functions in the Reggeon calculus. Our renormalization-group integration method gives the t dependence of the asymptotic scaling functions, as well as the correction terms which are present at nonasymptotic energies. The approach to the scaling form is governed by a critical exponent. The method can be used to calculate the scaling form and the approach to scaling of any n-to-m Reggeon Green's function. We discuss mainly the Pomeron propagator and the three-point function in the one-loop approximation. (auth)

18712 CONSTRUCTION OF A UNITARY ANALYTIC SCATTERING AMPLITUDE. IV. Many Two-Body Channels. Atkinson, D.; Mahoux, G.; Yndurain, F. J. (Rijksuniversiteit Groningen (Netherlands)). Nucl. Phys., B; 98: No. 3, 521-532(10 Nov 1975).

The authors extend previous results concerning the existence of unitary amplitudes that correspond to a given differential cross section to the many-channel case. They use $\cos\theta$ analyticity and show that all of the one-channel results may be adapted to the more general problem. A new constraint, the commutativity of the dispersive and absorptive parts, is shown to be automatic in all but exceptional singular cases. (NL)

18713 ANALYTIC PROPERTIES OF THE REGGEON–REGGEON AMPLITUDE. Kwiecinski, J. (Science Research Council, Chilton (UK). Rutherford Lab.). Nucl. Phys., B; 97: No. 3, 475-492(20 Oct 1975).

The analytic properties of the reggeon–reggeon amplitude in the missing-mass-like variable are discussed. (This amplitude is defined through the suitable high-energy limit of the eight-point amplitude). It is shown on the basis of simple Feynman diagrams that it is possible to define reduced amplitudes which are free from kinematical singularities, provided that the eight-point amplitude is expressed in a form explicitly consistent with Steinmann relations. In a simple model which is considered in this paper, the reduced amplitudes have the singularity structure of ordinary two-body scattering amplitudes. The finite-energy sum rules and four-Reggeon vertices are also briefly discussed. (NL)

18714 FINITE INTERACTION FROM AN EVANESCENT COUPLING. Bollini, C. G.; Giambiagi, J. J. (La Plata Univ. Nacional (Argentina). Departamento de Fisica). Nucl. Phys., B; 97: No. 3, 522-526(20 Oct 1975).

The first-order vertex radiative corrections are computed in a theory in which the only interaction is an evanescent one of the form $[\gamma_5, \gamma_\mu]$. An effective finite γ_5 interaction is obtained. (NL)

PHYSICS (LOW-TEMPERATURE)

Superconductivity

Refer also to abstracts 17008, 17031, 17604, 17627, 17647, 17654, 17656, 17657, 17659, 17660, 17688, 17696, 17699–17706, 17717, 17725, 17740, 17746, 17747, 17752–17755, 17757, 17759, 17760, 17767–17772, 17774, 17782, 17785, 17788, 17791, 17802, 17810, 17812, 17815, 17818–17842, 17855–17859, 17878, 17888, 17889, and 19205.

18715 (CALT-822-77) SUPERCONDUCTIVITY IN TIGHT-BINDING APPROXIMATION. Poon, S. J. (California Inst. of Tech., Pasadena (USA). W. M. Keck Lab. of Engineering Materials). Oct 1975. Contract AT(04-3)-822. 12p. Dep. NTIS $3.50.

An interpretation of Barisic's relation for transition elements between the d-electron contribution to the cohesive energy and the local atomic parameter eta is presented. This relation is extended to a lattice with more than one atom per unit cell in the tight-binding approximation of rigid ions. It is conjectured that Barisic's relation is correct to first order approximation for transition metal alloys, provided the phonon induced d-d coupling is the dominant mechanism for superconductivity. (auth)

18716 ATTENUATION OF LONGITUDINAL SOUND IN SUPERCONDUCTORS. Vardanyan, R. A.; Lisitsyn, S. G. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 4, 1267-1274(Oct 1975). (In Russian)

Attenuation of longitudinal sound in superconducting alloys is investigated in the free electron model on the basis of a gauge-invariant equation set. It is found that in the low frequency range the expression for the sound attenuation factor depending on electric fields differs from the BCS formula. (auth)

18717 TEMPERATURE DEPENDENCE OF THE ELECTROMAGNETIC RESPONSE FUNCTION FOR STRONG-COUPLING AMORPHOUS Bi FILMS. Lejeune, J. D.; Naugle, D. G. (Texas A and M Univ., College Station). J. Low Temp. Phys.; 22: No. 3/4, 425-435(Feb 1976).

The temperature dependence of the electromagnetic response function I(0, 0, T) has been inferred from the temperature dependence of the kinetic inductance of thin, amorphous Bi films. For normalization purposes I(0, 0, 0) has been calculated from tunneling data with the microscopic strong-coupling theory. The results are not consistent with scaled weak-coupling theory, but instead exhibit strong-coupling effects. The calculated value of I(0, 0, 0) is approximately 40 percent below the BCS value for a weak-coupling superconductor, qualitatively in agreement with determinations of I(0, 0, 0) for Pb by Kerchner and Ginsberg. The temperature dependence of I(0, 0, T) differs in the opposite direction from the BCS dependence as that observed for Pb. 4 figures. (auth)

18718 TRANSPORT PROPERTIES OF SUPERCONDUCTING MAGNETIC ALLOYS IN THE WEAK-COUPLING THEORY. Lam, J. (Dikewood Industries, Inc., Albuquerque, NM). J. Low Temp. Phys.; 22: No. 3/4, 455-465(Feb 1976).

The acoustic attenuation coefficient, the nuclear spin relaxation rate, and the electronic thermal conductivity of superconducting magnetic alloys are calculated in the weak-coupling theory developed in a previous publication. This theory generalizes the Bardeen–Cooper–Schrieffer theory of pure superconductors by considering a finite electron lifetime arising from magnetic impurity scattering. The transport coefficients are expressed as two-electron Green's functions and evaluated in the independent-particle approximation. 3 figures. (auth)

18719 EFFECT OF DYNAMIC MIXING ON COLLECTIVE AND LOCALIZED STATES ON THE CRITICAL TEMPERATURE OF SUPERCONDUCTORS. Kuz'min, E. V.; Ovchinnikov, S. G. (Inst. of Physics, Novosibirsk, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1688-1696(Nov 1975). (In Russian)

A model of d(f)-metals with localized levels immersed in the conductivity band is considered. When the transition energy Ω between configurations d^{n+1} and d^n is close to the Fermi energy μ the metal becomes unstable with respect to formation of bound states between conductivity electrons and d(f)-ions. As a result a gap $2\Delta_m$ appears in the conductivity band and the density of states at the edge of the gap is much greater than the initial density. Consequently Cooper pairing under such conditions may result in superconductivity with a high transition temperature T_s. Restrictions on the electron spectrum parameters are obtained and the region of interaction constants λ_m and λ_s is found for which the gap Δ_m and superconducting gap Δ_s may exist simultaneously. (auth)

18720 COLLECTIVE EXCITATIONS WITH A SOUND SPECTRUM IN SUPERCONDUCTORS. Artemenko, S. N.; Volkov, A. F. (Inst. of Radiotechnology and Electronics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1764-1767(Nov 1975). (In Russian)

It is demonstrated theoretically that in superconductors with a low impurity concentration there may exist weakly damped oscillations of the longitudinal electric field and order parameter phase with a spectrum $\omega = kV$. These excitations are related to oscillations of the population differences in branches of the quasiparticle energy spectrum. (auth)

18721 EFFECT OF TIN IMPURITIES ON THE TEMPERATURE DEPENDENCE OF DISORDERING OF LEAD IN SUPERCONDUCTING TRANSITIONS. Startsev, V. I.; Abraimov, V. V.; Soldatov, V. P. (Physical-Technical Inst., Kharkov). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1834-1840(Nov 1975). (In Russian)

The effect of tin impurities and preliminary deformation on the temperature dependence of the disordering effect $\delta\epsilon_{ns}$ during a superconducting transition is investigated in lead. The experiments show that an important feature of the temperature dependence of $\delta\epsilon_{ns}$ in doped and strongly deformed lead alloys is its nonmonotonous variation for $T/T_c = 0.7$. The experimental data are compared with the fluctuation theory of disordering of metals during an N–S-transition and satisfactory qualitative agreement is observed. The temperature dependence of the energy gap $\Delta(\Gamma)$ in deformed and doped lead alloys is obtained on basis of the experimental temperature dependence of $\delta\epsilon_{ns}$. (auth)

18722 NONSTATIONARY ACOUSTOELECTRIC EFFECTS ON PROPAGATION OF TRANSVERSE SOUND IN SUPERCONDUCTORS. Gal'perin, Yu. M.; Kozub, V. I. (Ioffe Inst. of Physics and Tech., Leningrad). Zh. Eksp. Teor. Fiz.; 69: No. 2, 582-589(Aug 1975). (In Russian)

Vortex currents with both normal and superconducting components appear in a superconductor on propagation of transverse sound in it. The presence of a superconducting component of the vortex current affects the order parameter of the superconductor. Two effects related to this influence are considered. The first consists in the appearance of a nonstationary phase shift of the order parameter in a suitably designed superconducting measuring circuit when the latter is connected to the superconductor, the phase shift being proportional to the sound amplitude. The second effect consists in the presence of a current in the superconductor produced by nonelectromagnetic processes; it is connected with the influence of vortex currents on the order parameter modulus. The nonstationary phase difference recorded by the measuring circuit in this case is proportional to the square of the sound amplitude and varies with the double sound frequency. (auth)

18723 THRESHOLD PHENOMENA IN SUPERCONDUCTORS. Ivlev, B. I. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 2, 656-661(Aug 1975). (In Russian).

A thin superconducting film in an alternating electromagnetic field of frequency close to Δ is considered. It is shown that near the threshold $\epsilon = \Delta$ the density of states strongly changes. The nonequilibrium electron energy distribution function which arises, variation of the order parameter, dissipation current and tunneling characteristic are considered. (auth)

18724 CORRELATION FUNCTIONS IN ONE-DIMENSIONAL SYSTEMS WITH STRONG INTERACTION. Efetov, K. B.; Lapkin, A. I. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 2, 764-776(Aug 1975). (In Russian)

Correlation functions of a one-dimensional Fermi gas with infinitely strong attraction are found. It is shown that wave excitations make the main contribution to the formation of the correlation function characteristics. It is suggested that sound excitations are also important in the case of arbitrary attraction. The form of the correlation functions for arbitrary attraction is derived on basis of this hypothesis. The results obtained are applicable to a one-dimensional Bose gas with repulsion. Quasi-one-dimensionality effects are considered which lead to dielectric or superconducting transitions. (auth)

18725 CO-EXISTENCE OF SUPERCONDUCTING AND DIELECTRIC PHASES IN QUASI ONE-DIMENSIONAL SYSTEMS. Gabovich, A. M.; Pashitskii, E. A. (Inst. of Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 6, 1041-1043(Jun 1975). (In Russian).

It was shown that in quasi one-dimensional systems, by taking into consideration processes of electron flipover and crossover

Cooper pairing, the co-existence of superconducting and dielectric (Peierls) states are possible in a wide range of values of the interaction constant. (tr-auth)

18726 KINETICS OF FLUCTUATIONS IN PURE SUPERCONDUCTORS. Aronov, A. G.; Katilus, R. Zh. Eksp. Teor. Fiz.; 68: No. 6, 2208-2223(Jul 1975). (In Russian)

A theory of the kinetics of classical fluctuations in pure superconductors below the transition point is developed. It is assumed that the frequency and wave vector satisfy the conditions $(h/2\pi)\omega \ll \Delta$, $q \ll \Delta/(h/2\pi)(v_F)$. The cause of the fluctuations are collisions of normal excitations with impurities and phonons. The spectrum and spatial dispersion of fluctuations of the order parameter modulus, phase and superfluid velocity are investigated. Fluctuation-dissipation theorems are formulated which relate the fluctuation spectral densities of the quantities with the respective impedances. Magnetic flux fluctuations in a superconducting ring are discussed as well as the effect of phase fluctuations on the line width in the Josephson effect. (auth)

18727 CURRENT FLOW IN LONG SUPERCONDUCTING CONSTRICTIONS. Kulik, I. O.; Omel'yanchuk, A. N. (Physical-Technical Inst., Kharkov). Zh. Eksp. Teor. Fiz.; 68: No. 6, 2139-2148(Jun 1975). (In Russian)

Current states in long superconduction junctions (of the S-C-S type) are investigated. The Josephson model is applied for $a \ll d \ll \xi$ (a is the junction radius, 2d its length and ξ the coherence length). The critical current is shown to be determined by the concentration of the superconducting carriers. N_s and the value of the current density exceeds the depairing current j_d. For $d \gg \xi$ macroscopic quantization of the system state occurs, thus leading to a nonunique dependence of the current on phase. Criteria for realization of branches of the energy $E_n(\varphi)$ and current $I_n(\varphi)$ dependences on phase φ in stationary or dynamic regimes are discussed. The amplitude of the alternating Josephson current decreases with junction length according to a $I_a \sim 1/d$ law. (auth)

18728 EFFECT OF IMPURITY MODES WITH QUASILOCAL AND LOCAL FREQUENCIES ON THE TEMPERATURE OF A SUPERCONDUCTING TRANSITION. Zhernov, A. P.; Malov, Yu. A.; Panova, G. Kh. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 1, 255-265(Jul 1975). (In Russian).

An isotropic irregular superconductor is considered. The effective interaction parameter λ due to electron pairing is assumed to be smaller or of the order of 0.5. The Eliashberg integral equation set is solved for $T \to T_c$. A simple analytic expression is obtained for T_c. The variation of T_c in superconductors with impurity atoms is analyzed in detail. Its dependence on parameters describing the phonon spectrum of the impurity system is investigated. It is found that the presence of impurity modes with quasilocal and local frequencies in the phonon spectrum may lead to either comparatively small or very appreciable changes of T_c. The first case is typical when the impurity atom is practically an isotopic defect. If the impurity atom is very heavy ($M_1 \gg M_0$) the corresponding relative correction δT_c to T_c should be negative and δT_c on the order of c ln (M_0/M_1). For a small mass defect the factor δT_c, generally speaking, should be positive but $\delta T_c \ll c$. The second case occurs if the impurity atom is anomalously weakly ($\gamma_1 \ll \gamma_0$) or strongly ($\gamma_1 \gg \gamma_0$) coupled to the matrix atoms. A sharp decrease of the effective force constant (γ_1) for the impurity atom results in an increase of δT_c. In contrast, an increase of γ_1 results in the appearance of a negative correction to T_c. A comparison with the experimental data is carried out. A qualitative description of the variation of T_c due to the presence of impurities is presented for a number of solutions. The quantitative agreement between the calculated and experimental values of δT_c is satisfactory. (auth)

18729 CRITICAL CURRENT DENSITY FOR SUPERCONDUCTORS OF THE SECOND KIND IN THE MIXED STATE. Krasnov, Yu. K.; Shukhman, V. A. (Inst. of Physics, Tbilisi, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 1, 311-318(Jul 1975). (In Russian).

A phenomenological approach for describing the resistive state is applied to the case of interaction between vortices with pinning centers. Equations of motion of a vortex in a pinning force field are derived. An exact solution of the dynamic equations for concrete interaction potentials between the vortex and pinning center is presented. It is shown that two characteristic values of the transport current should be discerned. One is related to detachment of the vortex from the pinning center and the other to capture of a vortex scattered by the center. Both values are shown to depend on the Hall angle, the detachment current also depending on the rate at which the external current is switched on. The influence of these effects on the current-voltage characteristics in the mixed state is discussed. (auth)

18730 HEAT TRANSFER IN TYPE II SUPERCONDUCTING ALLOYS. Kopnin, N. B. (Landau Inst. of Theoretical Physics, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 1, 364-376(Jul 1975). (In Russian).

An expression for heat current in superconducting alloys is obtained on basis of nonstationary superconductivity theory. It is shown that in the mixed state the energy dissipation mechanism proposed by Clem is absent. The Ettingshausen and Nernst effects are investigated near the critical temperature and weak fields $H \ll H_{c2}$. Anisotropy of thermal conductivity in the mixed state is considered near T_c and at low temperatures. (auth)

18731 THERMAL MECHANISMS OF DISSIPATION IN SUPERCONDUCTORS OF THE SECOND KIND. Gasparyan, R. A.; Kresin, V. Z. (Moscow Correspondence State Pedagogical Inst.). Zh. Eksp. Teor. Fiz.; 69: No. 1, 377-385(Jul 1975). (In Russian).

The thermal mechanism of dissipation connected with the appearance of temperature gradients in the vortex structure on passage of a transport current is investigated. The viscosity coefficients and corresponding contribution to the differential resistance ρ_f are calculated. A minimum in ρ_f is observed at a certain temperature t_m. The depth of the minimum and dependence of t_m on field strength H are investigated. The results obtained are in sufficiently good agreement with the experimental data. (auth)

18732 DESCRIPTION OF COULOMB INTERACTION IN SUPERCONDUCTIVITY THEORY AND CALCULATION OF T_c. Dubovskii, L. B.; Kozlov, A. N. (Inst. of Atomic Energy, Moscow). Zh. Eksp. Teor. Fiz.; 68: No. 6, 2224-2235(Jun 1975). (In Russian).

A method is proposed for solving the Eliashberg equation for anisotropic superconductors in the temperature technique for $T = T_c$. The procedure of successive Coulomb interaction between electrons is described and a definition of the Coulomb pseudopotential in the anisotropic model is presented. A general expression of T_c is obtained by taking into account corrections of the order of λ, the renormalized electron-phonon coupling constant. The dependence of the effective mass on energy yields a contribution to the correction of the order of λ^2 and higher. For the Einstein model T_c is calculated with an accuracy to λ^3. For a phonon spectrum model consisting of two Einstein peaks the equations are solved numerically and the dependence of T_c on frequency ω_1 of one of the peaks is determined. It is shown that for $\omega_1 \to 0$ the peak yields a finite contribution to T_c if $\lambda_1 \approx \omega_1^{-2}$. If $\lambda_1 \approx \omega_1^{-2+\nu}$, where $\nu > 0$ then in the limit of $\omega_1 \to 0$ the contribution from the low-frequency peak vanishes. (auth)

18733 NON-JOSEPHSON RADIATION IN A CAVITY WITH A SUPERCONDUCTING JOSEPHSON JUNCTION. Gubankov, V. N.; Kuz'min, L. S.; Lukharev, K. K.; Semenov, V. K. (Inst. of Radio Engineering and Electronics, Moscow). Zh. Eksp. Teor. Fiz.; 68: No. 6, 2301-2314(Jun 1975). (In Russian).

The possibility is investigated of the appearance in a Josephson junction cavity of non-Josephson radiation with the frequency of the cavity, the usual Josephson oscillations being generated simultaneously. Conditions for appearance of non-Josephson radiation are investigated; the amplitude, frequency and effect on the volt-ampere characteristic of the junction are calculated for the radiation. Non-Josephson radiation is investigated experimentally and the results are compared with the theory. Noise is shown to considerably affect the characteristics of the phenomenon. The validity of the Josephson relation for various definitions of the Josephson frequency is discussed. (5 figures) (auth)

18734 MEASUREMENT OF THE DOMAIN DRIFT VELOCITY IN THE INTERMEDIATE SUPERCONDUCTIVITY STATE. Krylov, I. P. (Inst. of Physical Problems, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 3, 1058-1062(Sep 1975). (In Russian).

The voltage which arises on passage of a direct electric current through a cylindrical sample in the intermediate state is measured. On the sample surface a perturbation arises of a stationary homogeneous magnetic field which is periodic along the cylinder axis. In this case an additional voltage appears at the ends of the sample which is due to movement of the intermediate state structure in an inhomogeneous field. For a perturbation uniformly moving along the cylinder axis the additional voltage is determined by the difference between the perturbation velocity and drift velocity of the local structure deformations. For equal velocities the additional voltage vanishes. On this basis it is possible to measure the dependence of the drift velocity on current through the sample. In agreement with the theory the drift velocity is found to be proportional to the current density and independent of configuration of the normal and superconducting layers. (auth)

18735 EXCITATION OF SOUND IN SUPERCONDUCTORS BY AN ELECTROMAGNETIC WAVE. Golub, A. A. (Inst. of Applied

Physics, Kishinev, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 3, 1007-1012(Sep 1975). (In Russian).

The problem of transformation of electromagnetic waves into sound waves in superconductors is considered. The limits of London and Pippard superconductors are considered. It is shown that for Pippard superconductors the main contribution to the transformation coefficient is from volume forces whereas the role of surface forces is less significant. A consequence of this is that interference effects become much weaker. (auth)

18736 POSSIBLE RELATIONSHIP BETWEEN DYNAMIC INSTABILITY OF A LATTICE AND SUPERCONDUCTIVITY IN SEMICONDUCTORS. Kristofel', N.N. (Institute of Physics, Academy of Sciences of the Estonian SSR, Tartu). Sov. Phys.—Solid State 17: No. 5, 909-910 (May 1975).

It is shown that in the presence of a soft transverse optical vibration mode, responsible for the Umklapp processes in a many-valley polar semiconductor, we can expect (subject to certain approximations) an anomalous increase in the electron—electron attraction constant on approach to the structure transition point. This may give rise to superconductivity. An estimate is obtained of the difference between the superconducting and structure transition temperatures. (auth)

18737 EFFECT OF MAGNETIC IMPURITIES ON FLUCTUATIONS IN SUPERCONDUCTING FILMS ABOVE T_c. Entin-Wohlman, O. (Department of Physics and Astronomy, Tel-Aviv University, Tel-Aviv, Israel); Orbach, R. Phys. Rev. B 12: No. 11, 4812-4815 (1 Dec 1975).

We calculate the effect of magnetic impurities on the excess tunneling current, caused by fluctuations in a Josephson junction. The two metals on opposite sides of the junction have different transition temperatures. At temperatures immediately above the transition temperature T_c of the low-T_c side, the excess current versus voltage is found to have a quasi-Lorentzian shape, exactly as in the absence of pair-breaking mechanisms. However, the pair relaxation frequency is reduced by the pair-breaking mechanism, and the coherence length is enhanced. This causes a detectable diminution in the peak voltage, which can serve as a direct measure of the pair-breaking strength. It is suggested that this effect could be used to probe the critical scattering of conduction-electron spins in the vicinity of the magnetic-ordering temperature. (auth)

18738 PHENOMENOLOGICAL APPROACH TO HIGH-TRANSITION-TEMPERATURE SUPERCONDUCTING ALLOYS. Poon, S.J.; Johnson, W.L. (W. M. Keck Laboratory of Engineering Materials, California Institute of Technology, Pasadena, California 91125). Phys. Rev. B 12: No. 11, 4816-4824 (1 Dec 1975).

Correlations between the observed maximum superconducting transition temperature T_c for a given binary alloy system and the alloy melting temperature T_m are pointed out. The stability of alloy phases favorable for high-temperature superconductivity is discussed in terms of alloy phase diagrams. A comparison with the microscopic theory shows that the correlation between T_c and T_m can be interpreted in terms of the *d*-electron contribution to the cohesive energy of transition-metal alloys as proposed by Barišić, Labbé, and Friedel. The prospects for obtaining high T_c's are discussed in view of these results, and new alloy systems are suggested. (auth)

18739 SPECIFIC HEAT OF GINZBURG-LANDAU FIELDS IN THE n^{-1} EXPANSION. Bray, A.J. (Center for Theoretical Physics, University of Maryland, College Park, Maryland 20742). Phys. Rev. B 12: No. 11, 4830-4835 (1 Dec 1975).

The n^{-1} expansion for the specific heat C_v of the n-component Ginzburg-Landau model is discussed in terms of an n^{-1} expansion for the irreducible polarization. In the low-temperature limit, each successive term of the latter expansion diverges more strongly than the last, invalidating a truncation of this series at any finite order in $1/n$. The most divergent terms in each order are identified and summed. The results provide justification for the usual truncated expansions for C_v. (auth)

18740 LANDAU-GINZBURG THEORY FOR PHASE TRANSITIONS IN MAGNETIC-SUPERCONDUCTING SANDWICHES. Entin-Wohlman, O.; Deutscher, G. (Department of Physics and Astronomy, Tel-Aviv University, Tel-Aviv, Israel); Alexander, S. Phys. Rev. B 12: No. 11, 4854-4859 (1 Dec 1975).

The phase diagram of a magnetic-superconducting sandwich below the Curie temperature of the magnetic side is considered. A coupling parameter between the two order parameters is determined from the microscopic properties. For strong coupling the superconducting transition is first order. It is shown that one is always in the weak-coupling limit when the magnetic material has localized spins. (auth)

18741 PROXIMITY EFFECTS BETWEEN SUPERCONDUCTING AND MAGNETIC FILMS. Entin-Wohlman, O. (Department of Physics and Astronomy, Tel-Aviv University, Tel-Aviv, Israel). Phys. Rev. B 12: No. 11, 4860-4866 (1 Dec 1975).

The effect of magnetic impurities in the normal-metal side of a normal-metal–superconductor (*N-S*) "dirty" sandwich on the transition temperature of the sandwich is considered. We derive a sum rule for the kernel of the gap equation, which enables us to obtain the transition temperature in the Cooper limit. The effect of a magnetic order in the normal-metal side at temperatures close to the Curie temperature is discussed, both in the Cooper limit and in thicker films, using in the latter case Werthamer's approximation. (auth)

18742 SUPERCONDUCTING PROXIMITY EFFECT IN THE STRONG-COUPLING LIMIT. Silvert, W. (Dalhousie University, Halifax, Nova Scotia, B3H 3J5 Canada). Phys. Rev. B 12: No. 11, 4870-4873 (1 Dec 1975).

Some of the basic results of the theory of the superconducting proximity effect have been generalized to apply to strong-coupling systems. The results agree with Moormann's theory of the proximity effect between weak-coupling superconductors with different Debye frequencies and also indicate that logarithmic frequency averaging is correct. The theoretical results are compared with experimental data on thin films and eutectic alloys, and the agreement is very good. (auth)

18743 FIELD-THEORETIC TECHNIQUES AND CRITICAL DYNAMICS. I. GINZBURG-LANDAU STOCHASTIC MODELS WITHOUT ENERGY CONSERVATION. De Dominicis, C.; Brézin, E.; Zinn-Justin, J. (Service de Physique Théorique, Centre d'Etudes Nucléaires de Saclay, BP. 2-91190 Gif-sur-Yvette, France). Phys. Rev. B 12: No. 11, 4945-4953 (1 Dec 1975).

Renormalization techniques of field theory are used to prove (order by order to all orders) dynamical scaling laws on a Ginzburg-Landau stochastic model studied by Halperin, Hohenberg, and Ma. The dynamical exponent is calculated to order ϵ^3 and so is the new exponent ω_b, which governs the vanishing of the imaginary part of the (renormalized) kinetic coefficient, and appears among the corrections to scaling. Difficulties of previous calculations taking a microscopic approach to the critical dynamics of a Bose system are commented upon. (auth)

18744 SUPERCONDUCTING RING FLUXMETERS. Long, C. (Route 6, Box 159D, Tallahassee, Florida 32301). Phys. Teacher 13: No. 9, 532-537 (Dec 1975).

A brief review is given of the Meissner effect and its application to squids. (AIP)

18745 ^{4}He-INDUCED DAMAGE IN SUPERCONDUCTING Nb-Ge FILMS. Poate, J.M.; Testardi, L.R.; Storm, A.R.; Augustyniak, W.M. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. Lett. 35: No. 19, 1290-1293 (10 Nov 1975).

Defects introduced into superconducting Nb-Ge films by 2-MeV ^{4}He particles produce a T_c-resistance-ratio correlation similar to that for as-grown films and a T_c-lattice-parameter correlation resembling both film and bulk behavior. It is suggested that simple antistructure defects in a perfect lattice are not primarily responsible for lowering T_c for the case of ^{4}He damage in the sputtered films. (auth)

18746 FLUX-FLOW VOLTAGES AND FARADAY INDUCTION DURING GUIDED ENTRY OR EXIT OF FLUX IN HOLLOW SUPERCONDUCTING CYLINDERS. Khanna, S. M. (National Aeronautics and Space Administration, Huntsville, AL); LeBlanc, M. A. R. IEEE Trans. Magn.; MAG-11: No. 2, 354-357(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The instantaneous and integrated voltages detected between pairs of diametrically opposite contacts attached on the periphery of superconducting Nb tubes of different wall thicknesses were monitored as flux threading the walls and the hole is caused to change. For a chosen change of flux, the signals across a pair of contacts were found to depend dramatically on the configuration of leads to the contacts relative to the direction of flux motion. The persistent currents induced to flow azimuthally around the walls of the cylinder are made to collapse partially or completely and the flux retained in or shielded from the hole and the wall is made to exit or enter by applying heat at a narrow strip along the length of the tube. The numerous observations are consistent with the following picture. Changes of flux in the hole or in the walls generate a voltage only across the leads which embrace the region where entry or exit of flux occurs (only changes of magnetic flux in the measuring circuit excluding the superconducting volume contribute). (auth)

18747 EFFECTIVE RESISTANCE OF SUPERCONDUCTING WINDING IN OSCILLATING MAGNETIC FIELDS. Ogasawara, T. (Nihon Univ., Tokyo); Yasukochi, K.; Nose, S.; Sekizawa, H. IEEE Trans. Magn.; MAG-11: No. 2, 362-365(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

With the help of careful measurements of the terminal voltage appearing across a non-inductive winding of Nb–Ti wire we have studied the influence of oscillating magnetic fields on the transport current. It is possible to discuss the voltage versus oscillating field characteristics in terms of the critical state model, and good

agreement with experimental data has been achieved. The analysis shows that the voltage measurement gives some detailed information on the distribution of the magnetic induction inside the superconductor. An effective resistance R/sub eff/ appears in the transport current loop when the amplitude of the oscillating field exceeds a certain threshold value. The dependence of R/sub eff/ on amplitude and frequency of the oscillating field and on the wire diameter is discussed and the application of this analysis to the case of superconducting solenoids is outlined briefly. (auth)

18748 TUNNELING-CURRENT-INDUCED TRANSITIONS OF SUPERCONDUCTING THIN FILMS. Hebard, A. F. (Bell Telephone Labs., Murray Hill, NJ). IEEE Trans. Magn.; MAG-11: No. 2, 358-361(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

The resistive state of a superconducting film can be induced either by passing sufficient current along the film or by raising the temperature above T/sub c/. We have been studying this transition in aluminum films when they are injected with "hot" (i.e. nonthermal) phonons and electrons. This injection efficiently breaks electron pairs in the region near the injection point. These "hot" electrons and phonons are produced by tunnel junctions which incorporate or are adjacent to the Al film under study. This method of current injection usually results in significantly lower critical currents than the critical current measured conventionally along the film. Well-defined and reproducible critical currents together with I-V traces for the Al film, which under certain conditions are characterized by a series of constant current voltage steps, have been obtained with a variety of geometrical configurations and different tunnel junction resistances. (auth)

18749 ALTERNATING FIELD LOSSES IN MIXED MATRIX MULTIFILAMENT SUPERCONDUCTORS. Walker, M. S.; Murphy, J. H.; Carr, W. J. Jr. (Westinghouse Research Labs., Pittsburgh). IEEE Trans. Magn.; MAG-11: No. 2, 309-312(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Losses were calculated for and measured at 4.2^{0}K in two mixed-matrix superconductors for the cases of transverse applied alternating fields superimposed upon zero or 5T transverse bias fields. The 0.080 in. x 0.160 in. conductors are composites of copper-sheathed Nb–Ti filaments twisted every 5 cm within a copper–nickel matrix, where the copper–nickel to copper to superconductor ratio is nominally 4:4:1. The conductors differ only in the copper–nickel alloy of the matrix and the associated matrix conductivities, sigma /sub m/. Calorimetric measurements were performed with alternating fields ranging in frequency, f, from 0.3 to 12,800 Hz and from 2500 to 4 oersteds in amplitude H/sub m/. Eddy current losses consistent with the theory and proportional to H^2/sub m/f^2 sigma/sub m/ and H^2/sub m/f^0/sigma/sub m/ were observed. The measured losses were found to be less than the calculated losses and within 45 percent of the calculated losses in all cases. 5 figures (auth)

18750 ALTERNATING FIELD LOSSES IN A RECTANGULAR MULTIFILAMENTARY NbTi SUPERCONDUCTOR. Murphy, J. H.; Walker, M. S.; Carr, W. J. Jr (Westinghouse Research Labs., Pittsburgh). IEEE Trans. Magn.; MAG-11: No. 2, 313-316 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Transverse alternating field losses on a 1 mm x 1.4 mm monolithic multifilamentary composite superconductor were measured calorimetrically at 4.2K for frequencies between 0.1 Hz and 20,000 Hz. The conductor was placed in bias magnetic fields ranging from zero to 50 kOe and subjected to superimposed alternating fields with field amplitudes ranging from 10 Oe to 2 kOe. The classical partial penetration hysteresis loss and full penetration hysteresis loss were observed. Losses were also measured which can be attributed to eddy currents in the composite core. At very high frequencies, eddy current losses were observed resulting from the metallic sheath which encloses the composite core. The magnitude of the eddy current loss in the composite core is explained in terms of the diamagnetism exhibited by the superconducting filaments. The experimental data presented is analyzed using existing loss theories which have been appropriately modified using basic principles to account for the effect of filamentary diamagnetism at low alternating field amplitudes. (auth)

18751 ALTERNATING FIELD LOSSES IN Nb_3Sn MULTIFILAMENTARY SUPERCONDUCTOR. Murphy, J. H.; Deis, D. W.; Shaw, B. J.; Walker, M. S. (Westinghouse Research Labs., Pittsburgh). IEEE Trans. Magn.; MAG-11: No. 2, 317-320(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Transverse alternating field losses at 4.2K have been measured from 0.5 Hz to 10 kHz in a Nb_3Sn multifilamentary superconductor in bias fields to 5 Tesla. The 0.020 inch diameter sample was prepared by heat treating a Cu, Nb-1 wt percent Zr, CuSn composite at 700^{0}C for 20 hours to form Nb_3Sn on the inside surface of the annular filaments. Metallurgical studies have been made to determine the Sn distribution and to estimate the thickness of the Nb_3Sn layer. The I/sub c/-H curve and resistive and inductive transition curves are presented. The losses are analyzed with respect to the present loss theories using the conductor characteristics measured and excellent agreement between experiment and theory is achieved. 1 table, 6 figures. (auth)

18752 AC LOSSES OF MULTIFILAMENT SUPERCONDUCTORS AT FREQUENCIES BETWEEN 1 AND 500 Hz. Kwasnitza, K.; Horvath, I. (Inst. of Solid State Physics, Zurich). IEEE Trans. Magn.; MAG-11: No. 2, 321-323(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A report is given of calorimetric measurements of the ac losses of a small superconducting coil wound from a filament superconductor designed for low ac losses (filament phi equals 8 mu, number of filaments 1045, CuNi barriers). The coil was pulsed with a maximum dB/dt equals 480 kG/s. Further the ac losses were measured, when the coil current consisted of a dc- and a super-imposed ac component with 1 less than or equal to f less than or equal to 500 Hz. The modification of the ac losses by the dc component of coil field and coil current was investigated. 3 figures. (auth)

18753 MAGNETIZATION AND DESIGN OF MULTISTRAND SUPERCONDUCTING CONDUCTORS. Walters, C. R. (Brookhaven National Lab., Upton, NY). IEEE Trans. Magn.; MAG-11: No. 2, 328-331(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Magnetization of cabled and braided samples which are long compared to their transposition lengths has been measured in a uniform magnetizing field directed at right angles to their widths. A separated double pancake with nonuniform windings was constructed to produce a suitably uniform radial field in which long coiled samples could be placed. Magnetization losses have also been measured in the ISA I magnet at BNL. Results are compared with theories which are due to Wilson and, basically, Morgan. Also, design optimization procedures have been defined for the use of multistrand conductors in magnet windings. 7 figures, 3 tables. (auth)

18754 MAGNETIC FIELD MICROPROBE IN SUPERCONDUCTORS CARRYING A CURRENT. Migliori, A.; Bartlett, R. J.; Taylor, R. D. (Los Alamos Scientific Lab., NM). IEEE Trans. Magn.; MAG-11: No. 2, 347-349(Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

A new technique to probe local magnetic fields inside superconductors utilizing the Moessbauer Effect (ME) is reported. The ME nucleus responds to the local magnetic field resulting in a modified hyperfine ME spectrum from which the local field and its direction may be deduced. Concentrations of a few ppm of the radioactive probe nucleus are sufficient; the allowable depth of the probe depends on the attenuation of the ME gamma ray. For ^{57}Fe (^{57}Co parent) in superconductors the field acts directly on the nuclear moment and the resulting sensitivity is only a few kG. For a thin probe consisting of ^{57}Co in Pd the response is enhanced by the "giant" localized moment providing a sensitivity at 1 K of better than 100 G. Results of such a probe placed at various locations across a commercial Nb_3Sn tape carrying a current are reported and compared with calculations of the field profile using several models. For thin tape geometries the usual models prove to be inadequate. 4 figures. (auth)

18755 SUPERCONDUCTING STATE. Grassie, A. D. C. Graduate Student Series in Physics. New York; Crane, Russak and Company, Inc. (1975). 142p. $24.50.

From the wide range of experimental studies on superconductivity, those which throw most light on the changes which occur amongst the electrons of a metal when it is cooled through the superconducting transition are isolated. The character of the electron condensation into Cooper pairs is studied first for a single pair of electrons interacting through an attractive potential, related to the electron lattice interaction, and is then treated in such a way as to include the many electron aspects of the interaction, a process found to be necessary in the introductory study. The results of such theoretical treatments are assessed in the light of the experimental facts discussed previously, and the shortcomings of the Bardeen–Cooper–Schrieffer treatment are discussed. The Ginzburg–Landau equations are derived, and several examples of their use in such circumstances are given. Special

attention is devoted to the existence of the type II superconductors, and a discussion of flux pinning and creep in such materials is included. The unique description of the superconducting state as a macroscopic quantum state described by one single wavefunction throughout the superconductor leads to the possibility of varying degrees of coupling between neighbouring superconductors, and the arising Josephson effects are discussed along with examples of their application. (auth)

PHYSICS (NUCLEAR)

18756 (COO-3470-4) NUCLEAR REACTION STUDIES. Progress Report for Year Ending January 31, 1976. Alexander, J. M. (State Univ. of New York, Stony Brook (USA). Dept. of Chemistry). 1976. Contract AT(11-1)-3470. 15p. Dep. NTIS $3.50.

Research during 1975 was divided into three sections: I. Studies of the Interaction Barrier, II. Studies of Nuclear Fission, and III. Heavy Ion Reactions. In the first two areas we continue to collaborate with the Bordeaux group of Fleury and Delagrange. In the latter area we are collaborating with the Columbia group of Miller et al. in studies utilizing the Berkeley Superhilac. 3 figures, 1 table. (auth)

18757 (HMI-163) SCIENTIFIC PROGRESS REPORT 1/1974. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany). Bereich Kern- und Strahlenphysik). 1974. 166p. (In German). INIS.

The sector Nuclear and Radiation Physics is from the middle of 1974 onwards concerned with 5 research and development projects: 1.1 theoretical physics, 1.2 nuclear reactions, 1.3 nuclear moments and internal fields, 1.4 atomic collisions, 1.5 VICKSI. This is a report on the scientific work on these projects. (DE)

18758 YEARBOOK 1974. Keszthelyi, L. (ed.). Budapest; Central Research Institute for Physics (1974). 190p.

Brief papers are presented reviewing work in the following areas: fundamental problems of physics, high-energy physics, nuclear physics, solid-state physics, optics, chemistry, nuclear energy research, health physics, electronics, computing techniques, instrumentation, and mechanical engineering. Most of the papers have lists of publications appended, and it may reasonably be assumed that most of this work will appear in journal or report form in the open literature. (RWR)

Neutron Interactions with Matter

Refer also to abstracts 19587 and 19588.

18759 (BAW-10112) ETOGM: EPITHERMAL CROSS SECTION GENERATION CODE USING ENDF/B DATA. Wittkopf, W. A.; Tilford, J. M.; Kirschner, G. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Dec 1975. 145p. Babcock and Wilcox, Lynchburg, VA.

ETOGM processes ENDF/B FORMAT data to produce a master epithermal library containing multigroup cross sections, resolved and unresolved resonance parameters, and a scattering matrix for up to 100 materials of interest in reactor design calculations. The epithermal energy range may be divided into as many as 127 groups, and a weighting function may either be input or calculated by the code for use in calculating average group coefficients. Resonance contributions from thermal and negative energy resolved resonances, as well as infinite-dilute corrections in the epithermal range, are added to the appropriate smooth cross sections. Resolved and unresolved resonance parameters are tabulated when applicable. A combined inelastic-(n, 2n) scattering matrix is calculated from secondary neutron energy distribution data. A fission spectrum is computed for each fissionable material. The master epithermal library is generated, updated, and edited by the ETOGM program. (auth)

18760 (RL-75-129) CHOICE AND OPTIMIZATION OF A MODERATOR FOR A PULSED SLOW-NEUTRON SOURCE. Neutron Moderation in Ice and Polyethylene at Low Temperature. Ishmaev, S. N.; Sadikov, I. P.; Chernyshov, A. A. (Science Research Council, Chilton (UK). Rutherford Lab.). Aug 1975. Translation of Russian Papers. 32p. Dep. NTIS (US Sales Only) $5.00.

This document from Rutherford Laboratory, U.K., comprises translations of two papers by S. N. Ishmaev, I. P. Sadikov and A. A. Chernyshov of the I. V. Kurchatov Institute of Atomic Energy, as follows: translation of IAE-2019 entitled "The Choice and Optimization of a Moderator for a Pulsed Slow-Neutron Source," and translation of IAE-2271 entitled "Neutron Moderation in Ice and Polyethylene at Low Temperature." Separate abstracts were prepared for each. (UK)

For abstracts of individual papers see: 18761 and 18762.

18761 (RL-75-129, pp vp, Paper 1) CHOICE AND OPTIMIZATION OF A MODERATOR FOR A PULSED SLOW-NEUTRON SOURCE. Ishmaev, S. N.; Sadikov, I. P.; Chernyshov, A. A. (Inst. of Atomic Energy, Moscow). Aug 1975. Translation of IAE-2019.

In choice and optimization of a moderator for a pulsed slow-neutron source. Neutron moderation in ice and polyethylene at low temperature.

The neutron physics requirements are considered for a moderator intended for the production of intense pulsed fluxes of slow neutrons using the linear accelerator with a booster now being built at the Kurchatov Institute of Atomic Energy. In this paper the results are presented of the experimental investigations carried out with the object of optimizing hydrogenous moderators. The time dependence of the neutron flux for different energies and for various moderator compositions based on polyethylene and water was measured by means of a crystal spectrometer on the linear accelerator. The effect of the geometry, the thickness and the temperature of the moderator, the addition of absorbers and use of reflector-filters on the intensity and pulse width of monoenergetic neutrons was studied. (auth)

18762 (RL-75-129, pp vp, Paper 2) NEUTRON MODERATION IN ICE AND POLYETHYLENE AT LOW TEMPERATURES. Ishmaev, S. N.; Sadikov, I. P.; Chernyshov, A. A. (Inst. of Atomic Energy, Moscow). Aug 1975. Translation of IAE-2271.

In choice and optimization of a moderator for a pulsed slow-neutron source. Neutron moderation in ice and polyethylene at low temperature.

In order to study the problem of the optimization of a pulse source of slow neutrons on the Kurchatov Institute of Atomic Energy linear accelerator, an investigation has been made of the effect of deep cooling of hydrogenous moderators (H_2O and $(CH_2)_n$ at T = 300, 77 and 4.2°K) on the pulse shape of thermalized neutrons of various energies in a range from 0.0018 to 0.090 eV. At low temperatures polyethylene turns out to be a better moderator than ice; this is explicable by the greater normal oscillation level density in the low-energy part of the spectrum. Cooling $(CH_2)_n$ to T = 4.2°K makes it possible to increase by 7 times the pulse amplitude of neutrons with an energy of 0.0018 eV, and the total neutron output by 16 times in comparison with T = 300°K. For the energy range 0.1 to 0.01 eV, moderator cooling allows the neutron pulse width to be reduced by 2 to 3 times without loss of peak intensity. This improves significantly the conditions for spectroscopic time-of-flight resolution in this energy range. (auth)

18763 COMPUTATIONAL EXPERIMENTS WITH A CALIFORNIUM-252 SOURCE FOR POSSIBLE USE IN NEUTRON RADIOGRAPHY. Kedem, D.; Lemanska, M. (Soreq Nuclear Research Centre, Yavne, Israel). Nucl. Technol.; 28: No. 1, 152-158 (Jan 1976).

The thermal-neutron flux produced by a ^{252}Cf spontaneous fission neutron source was computed for various spherical assemblies with moderators of iron, aluminum, carbon, D_2O, beryllium, and H_2O and reflectors of H_2O and carbon. Consideration of spherical assemblies with a ^{252}Cf source located at the center and at various distances from the center lead to a configuration, adaptable to neutron radiography, that has a small thermalization factor and a flat thermal-neutron flux.

18764 DETERMINATION OF SPATIAL ORIENTATION OF NEUTRON POLARIZATION AND INVESTIGATION OF MAGNETIZATION NEAR THE PHASE TRANSITION POINT. Okorokov, A. I.; Runov, V. V.; Volkov, V. I.; Gukasov, A. G. (Leningrad Inst. of Nuclear Physics). Zh. Eksp. Teor. Fiz.; 69: No. 2, 590-598 (Aug 1975). (In Russian)

A new method is described for analyzing polarization of a neutron beam. It is based on projecting the polarization onto the direction of the magnetic field and may be used for determining spatial orientation of the polarization vector. This type of three-dimensional analysis of polarization is employed for investigating the magnetization of an iron-yttrium ferrite-garnet near the Curie temperature. The spontaneous magnetization M_s possesses a macroscopic spatial inhomogeneity and the temperature dependence $M_s(T)$ corresponds to a variable critical index β up to $\beta > 1$.

18765 MODERATION OF ^{241}Am-Be NEUTRONS IN PARAFFIN WAX. Ahmad, I.; Morris, D. F. C. (Brunel Univ., Uxbridge, Eng.). Radiochem. Radioanal. Lett.; 23: No. 3, 119-124 (15 Nov 1975).

Neutron-flux measurements in a block of paraffin wax surrounding a 1 Ci ^{241}Am-Be source have been made by activation of indium or gold foils. A discrimination between thermal and resonance neutrons was made by wrapping the foil in cadmium. Magnitudes

of moderation parameters are derived and examined. (1 table, 2 figures) (auth)

18766 MEASUREMENT AND CALCULATION OF NEUTRON SPECTRA AT A SODIUM–IRON INTERFACE. Kappler, F. (Kernforschungszentrum, Karlsruhe, Ger.). Nucl. Technol.; 27: No. 2, 224-232(Oct 1975).

The problem of strong space-dependent neutron spectra appearing at boundaries is studied at a sodium-iron interface in slab geometry. The spatial neutron spectra from a 14-MeV neutron source were measured in the energy range from 100 eV to 4.5 MeV. For the energy E less than 200 keV, the time-of-flight method was employed and for E greater than 200 keV, proton-recoil detectors were used. In addition, calculations were performed with the Karlsruhe transport codes DTK and SNOW. The comparison of measured and calculated spectra, both functions of space and energy, showed that the spectrum around the sodium resonance is well described by 208 energy groups. A relationship is developed that is a function of the resonance parameters and the properties of the material concerned, from which it is possible to estimate the depth to which the flux depression at a resonance energy propagates into an adjacent material. (8 figures, 4 tables) (auth)

18767 PROPERTIES OF THE SOLUTION OF THE NEUTRON TRANSPORT BOLTZMANN EQUATION FOR SLABS AND SPHERES WITH FINITE REFLECTORS. Busoni, G.; Frosali, G.; Mangiarotti, L. (Univ., Florence). J. Math. Anal. Appl.; 52: No. 2, 220-234(Nov 1975).

The stationary neutron transport Boltzmann equation (in its integral form) is considered for slabs and spheres with finite reflectors. A very convenient simplification can be obtained in the case of a spherical core surrounded by a symmetrical reflector; indeed, if the total macroscopic cross-section is independent of position and the scattering is isotropic, then the determination of the spherically symmetrical neutron distribution in the system can be reduced to the study of a slab, whose half-thickness is equal to the radius of the sphere, with a reflector on each side of thickness equal to that surrounding the spherical core. Under this assumption, we can study only the integral equation for the case of the slab. The fact that the kernel of this integral equation is even is exploited in order to simplify the general discussion. Among the other results, the continuous and monotonical dependence of the critical number of secondaries per collision in the core upon the parameters characterizing the geometrical and material properties of the system is noted. Moreover, the neutron flux depends continuously on these parameters and the spatial coordinate. (auth)

18768 DISCRETE EIGENVALUE PROBLEM FOR AZIMUTHALLY DEPENDENT TRANSPORT THEORY. Shultis, J. K. (Kansas State Univ., Manhattan, KS); Hill, T. R. Nucl. Sci. Eng.; 59: No. 1, 53-56(Jan 1976).

The discrete eigenvalue problem associated with the one-speed azimuthal Fourier harmonics in plane geometry is discussed. An explicit expression, well-suited to numerical evaluation, is given for the dispersion function, and the reality and maximum number of discrete eigenvalues are demonstrated. From numerical examples, it is found that quite often there are no discrete eigenvalues, particularly for the higher harmonics. (auth)

Nuclear Properties and Reactions, A ≤ 5

Refer also to abstracts 18479, 18604, 18820, 19151, 19166, 19170, and 19344.

18769 (BNL-NCS-50446, pp 1-6) TOTAL HELIUM PRODUCTION CROSS SECTION FOR NEUTRON-INDUCED REACTIONS ON ^{6}Li FOR ENDF/B-IV. Stewart, L.; Hale, G. M. (Los Alamos Scientific Lab., NM). Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

Total neutron induced alpha production cross sections below 20 MeV are tabulated for ^{6}Li. The reactions included are (n,t), (n,n'd), and (n,2np). (SDF)

18770 (LYCEN-7518) ON THE PHOTODISINTEGRATION OF THE DEUTERON. Chetouani, L.; Hammann, T. F.; Desgrolard, P.; Hammann, T. F. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire). Mar 1975. 16p. INIS.

An analytical calculation of the total cross section of the ^{2}H(γ,p)n reaction at E(γ) < 30 MeV is presented using two realistic nonlocal separable N-N potentials. Exact analytical forms are given for all needed expressions. The results are in satisfactory agreement with the experimental data. The experimental cross section of the inverse process for thermal neutrons is reproduced within 3 to 5% accuracy. The results are found potential dependent. (FR)

18771 (ORO-4856-26, pp 85-86) SUPERMULTIPLET AND CLUSTER STRUCTURE OF NUCLEI A equals 4 – 10. Schenzle, D. (Univ., Tuebingen, Ger.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18772 (ORO-4856-26, pp 183-184) STUDIES OF THE ^{2}H(p,2p)n CROSS SECTIONS FOR CONSTANT NN RELATIVE ENERGIES AT 23.0 AND 39.5 MeV. McDonald, A. M. (Univ. of Manitoba, Winnipeg, Canada); Bonbright, D. I.; van Oers, W. T. H.; Watson, J. W.; Rogers, J. G.; Cameron, J. M.; Soukup, J.; Caplan, H. S.; Kloet, W. M.; Tjon, J. A. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18773 (ORO-4856-26, pp 185-186) NEUTRON TUNNELLING AS A MECHANISM FOR DIPROTON PRODUCTION IN THE SUN. McKee, J. S. C.; Randell, C. (Univ. of Manitoba, Winnipeg, Can.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The neutron tunneling model is shown to indicate that diproton production can be the dominant inelastic channel for the ^{3}He(^{3}He, ^{4}He)^{2}He reaction in the solar interior. (auth)

18774 (ORO-4856-26, pp 187-188) (p,2p) AND (p,pd) REACTIONS ON ^{3}H AND ^{3}He AT 45 MeV. Bonbright, D. I.; Elbakr, S. A.; Houdayer, A.; Miller, C. A.; Roberts, D. J.; Tin, E. S. Y.; van Oers, W. T. H.; Watson, J. W. (Univ. of Manitoba, Winnipeg, Can.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18775 (ORO-4856-26, pp 189-190) ^{3}H(p,pn)d QUASI-FREE SCATTERING AT 45.4 MeV. Bonbright, D. I.; Roberts, D. J.; van Oers, W. T. H.; Watson, J. W. (Univ. of Manitoba, Winnipeg, Can.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Data are presented on the angular dependence of quasi-free ^{3}H(p,pn)d scattering at 45.4 MeV. A marked difference between the data and the prediction of the PWIA is noted and related to other measurements of p,pn knockout on light nuclei. (auth)

18776 (ORO-4856-26, pp 191-192) POLARIZATION MEASUREMENTS AND HIGHLY EXCITED STATES IN ^{5}Li. Seiler, F. (Univ. of California, Berkeley). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Highly excited states in ^{5}Li are investigated by an analysis of ^{3}He(vector d,p)^{4}He data. Their influence is best seen in efficiencies for tensor polarization. It is shown that the analyzing power A/sub yy/ equals 1 at 9 MeV and forward angles.

18777 (ORO-4856-26, pp 195-196) CLUSTER STRUCTURE OF A equals 6 NUCLEI STUDIED WITH RADIATIVE CAPTURE REACTIONS. Ventura, E. (Rutgers Univ., New Brunswick, NJ). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

There are only four radiative capture reactions available to investigate the structure of the A equals 6 nuclei. They are: ^{3}H(^{3}He,gamma)^{6}Li; ^{3}He(^{3}He,gamma)^{6}Be; ^{3}H(^{3}H,gamma)^{6}He; and ^{4}He(d,gamma)^{6}Li. Of the above list, only the ^{3}H(^{3}He,gamma)^{6}Li and its inverse ^{6}Li(gamma,^{3}H)^{3}He have been extensively studied.

While the various capture cross sections are in good agreement with each other, serious discrepancies exist between the different photonuclear cross sections measured. However, a recent measurement of the ^{6}Li(gamma,^{3}H) cross section shows excellent agreement with the capture cross section and angular distribution data, hopefully establishing the correct cross section for this reaction. (auth)

18778 (ORO-4856-26, pp 228-229) SPIN DEPENDENCE OF THE DEUTERON OPTICAL POTENTIAL, THE DEUTERON D-STATE AND THE PAULI EXCLUSION PRINCIPLE. Ioanides, A. A.; Johnson, R. C. (Univ. of Surrey, Guildford, Eng.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The effect of the Pauli exclusion principle on the binding energy of a deuteron propagating in nuclear matter has been the subject of renewed interest recently. These calculations have been extended to include the influence of a tensor force component of the neutron-proton interaction of the Yamaguchi type. A consequence of the presence of D-state components in the deuteron is that for a given Fermi momentum and deuteron center-of-mass momentum, k, the deuteron binding energy is found to depend strongly on (s.k), where s is deuteron spin operator. The effect of the Fermi sea is to produce less binding on a deuteron with s.k equals 0 than with s.k. equals +- 1. This can be understood in a simple semi-classical picture in which account is taken of the orbital contribution to s from the deuteron D-state. (auth)

18779 (ORO-4856-26, pp 265-280) DISTORTED WAVE IMPULSE APPROXIMATION CALCULATIONS FOR QUASI-FREE CLUSTER REMOVAL REACTIONS. Chant, N. S.; Roos, P. G. (Univ. of Maryland, College Park). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

An analysis of quasi-free cluster removal reactions is presented taking into account distortion effects. Calculations are carried out using the distorted wave impulse approximation. The alpha cluster removal experiments are considered as examples. (11 figures, 11 references) (BJG)

18780 (ORO-4856-26, pp 301-302) PROTON KNOCK-OUT REACTIONS, A PROBE FOR THE CLUSTER SIZES IN NUCLEI. Jain, B. K.; Jain, A. K. (Bhabha Atomic Research Centre, Bombay). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18781 (ORO-4856-26, pp 303-304) QUASI-FREE (e,e'x) SCATTERING IN ^{6}Li AND ^{9}Be. Genin, J. P.; Julien, J.; Rambaut, M.; Samour, C. (CEN, Saclay, France). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Coincidence measurements of 556 MeV electrons scattered from ^{6}Li and ^{9}Be and of emitted alpha-particles and deuterons have been interpreted in PWIA, assuming cluster preformation. Momentum distributions of clusters in nuclei are deduced. (auth)

18782 (ORO-4856-26, 329-344) CLUSTERS AND EXOTIC PROCESSES. Schiffer, J. P. (Argonne National Lab., IL). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II: (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Some data is presented which may be construed as indicating that perhaps clusters play a role in high-energy and "exotic" (pion or kaon) interactions with complex (A much greater than 16) nuclei. Some very recent experimental work on pion interactions with nuclei is summarized which may or may not support a picture in which clusters play an important role. (14 references) (auth)

18783 (ORO-4856-26, pp 363-364) NUCLEAR SUBSTRUCTURE IN SOME DISSOCIATIONS OF LIGHT NUCLEI BY PROTONS AT 600 MeV and 24 GeV. Berthot, J. (Univ., Clermont, France); Fain, J.; Gardes, J.; Meritet, L.; Querrou, M.; Vazeille, F.; Ille, B. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18784 POLAR MECHANISM FOR THE ^{3}He(n,p)^{3}H and ^{2}H (d,p)^{3}H REACTIONS. Abdel Rida Al Hor; Blokhintsev, L. D.; Schwarz, I. A. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1956-1960(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2192-2197(Oct 1970).

Some of the simplest reactions that can be theoretically described in terms of the polar mechanism with a vertex corresponding to a virtual process of the type ^{3}H (^{3}He) → d + n (p) are dealt with. A typical example considered is the reaction ^{3}H + n → ^{3}H + p, the polar diagram of which is shown. One can therefore attempt to describe the differential cross section for reaction (1) at large angles θ with the aid of the amplitude Mp. The differential cross sections for d + d → ^{3}H + p are also described. It is concluded that even in a crude approximation the polar mechanism, with supression of the lowest phases, can satisfactorily describe the studied reactions. (JFP)

18785 VERTEX PART IN A THREE-BODY MODEL FOR ^{3}H REVERSIBLE n + d. Orlov, Yu. V. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1963-1966(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2201-2204(Oct 1970).

An attempt is made to calculate the vertex parts for virtual decay (fusion) of very light nuclei, thanks to recent progress in the quantum mechanical description of few-nucleon systems. The problem of the vertex part for the process ^{3}H ⇌ n + d is considered. (JFP)

18786 ANGULAR DEPENDENCE OF THE POLARIZATION VECTOR COEFFICIENT FOR NUCLEONS ELASTICALLY SCATTERED BY DEUTERONS. Il'in, I. M.; Serebryakov, S. G.; Komarov, V. V.; Popova, A. M.; Romanovskii, E. A. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1967-1970(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2205-2208 (Oct 1970).

The polarization is calculated for 2 (d,d) reactions with the aid of spin tensors without allowance for the spin-orbit and tensor interactions. The results indicate that nonzero polarization is obtained even when only the exchange (spin) interactions are neglected. The method is comparatively simple and gives good general agreement with experiment, so it is possible rapidly to determine the polarization as a function of angle and energy in the elastic scattering of polarized nucleons by unpolarized deuterons at low energies. (JFP)

18787 GENERALIZED ROTONS IN ELLIOT-TYPE MODELS. Mikhailov, I. N.; Nadzhakov, E. (Joint Inst. for Nuclear Research, Dubna, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1863-1866(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2088-2091 (Oct 1970).

Recently a new approach to the problem of rotation in heavy nuclei was developed which involves the formulation of equations for operators acting on the states of a rotational band. That approach is adapted to the description of rotation bands in light nuclei. (JFP)

18788 EFFECT OF THE MAGNETIC DIPOLE MOMENT OF THE TARGET NUCLEUS ON THE DEPOLARIZATION OF ELECTRONS EMITTING BREMSSTRAHLUNG. Kerimov, B. K.; Ablakulov, Kh. A.; Sadykhov, F. S. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1540-1544(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1732-1737(Aug 1970).

The Born approximation is used to calculate the angular and energy distributions and the degree of circular polarization of the bremsstrahlung from longitudinally-polarized relativistic electrons in the field of a nucleus with a magnetic dipole moment of $\mu_1 = \mu_1 I/I$, allowing for the longitudinal polarization of the electrons after the emission. Electron spin flip during bremsstrahlung and also the effect of the polarization of the final electron on the degree of circular polarization of the bremsstrahlung are investigated. Cross sections, polarization, and depolarization are discussed. To illustrate, the electron bremsstrahlung in the field of ^{7}Li is considered. (JFP)

18789 ENERGY AND ANGULAR DISTRIBUTIONS FOR THE REACTION ^{6}Li(e,e'p)^{5}He. Gonchar, V. Yu.; Inopin, E. V.; Mel'nik, Yu. P. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 5, 782-787(May 1975). (In Russian)

The cross sections of the reaction Li^6(e,e'p)He^5 were calculated with due regard for instability of the final nucleus for the disintegration into ^{4}He and a neutron. The calculations were carried out in the plane-wave impulse approximation. The results show that the satisfactory agreement can be reached simultaneously for energy and angular distributions with experimental data. However, the consideration of the instability does not lead to the improvement of the agreement of the obtained root-mean-square radius of the ^{6}Li nucleus with the value found from the experiments for the elastic electron scattering. (5 figures) (auth)

18790 NONLOCAL SEPARABLE POTENTIAL AND p–α SCATTERING. Ahmad, A. A. Z.; (Atomic Energy Centre, Dacca, Pakistan); Ali, S.; Ferdous, N.; Ahmed, M. Nuovo Cim.; 30A: No. 3, 385-392(1 Dec 1975).

A study was made of the s-, p-, d- and f-wave p–α scattering phase shifts up to a bombarding energy of 18 MeV, using a nonlocal separable interaction. Calculations were made in the coordinate representation in which the Coulomb forces were taken into account exactly. The separable-potential model of the nucleon-α interaction is found to be satisfactory. (auth)

18791 T(d,gamma)^{5}He REACTION. Batay-Csorba, P. A. Pasadena, CA; California Institute of Technology (1975). 122p. University Microfilms Order No. 75-25,845.

Thesis (Ph. D.).

The cross section for the reaction, T(d,gamma)^{5}He/sub g.s./, has been measured over the range of deuteron bombarding energies extending from 2 MeV to 12 MeV. A solid ZrT target was employed, and the cross sections were normalized by comparison with the well-known cross sections for the T(p, gamma)^{4}He reaction. A well shielded, 8" diameter by 5" long NaI(Tl) crystal, 31" from the target, was used to detect the capture gamma-radiation. Time-of-flight techniques were employed to suppress cosmic-ray background and neutron background arising mainly from the T(d,n)^{4}He reaction. Serious pulse pile-up problems were encountered because of an intense flux of lower energy gamma rays arising mainly from contaminants in the target. For a set of optical model potentials that describe the T + d differential elastic scattering, the direct radiative capture cross section for T(d, gamma)^{5}He was calculated. Although the cross section is underpredicted by about a factor of two, the calculated energy dependence of the cross section is similar to that observed. (Diss. Abstr. Int., B)

18792 STRUCTURE OF ^{4}He AND ^{12}C NUCLEI. Wadia, W. (International Centre for Theoretical Physics, Trieste, Italy); Moharram, S. Phys. Rev. C 12: No. 6, 2050-2055 (Dec 1975).

A wave function which is an admixture of the (0*s*) and (1*s*) states is found to account for the diffraction minimum of the form factor of elastic electron scattering by ^{4}He. Brink's cluster model for ^{12}C has been investigated by means of a convenient expansion procedure. The model is found to be substantially different from the classical α-particle model and to account satisfactorily for the high-energy electron scattering data. Further, the connection between Brink's model and the shell model has been established. (auth)

18793 PROTON-INDUCED ^{3}He BREAKUP AT 156 MeV. Didelez, J.P.; Frascaria, R.; Fujiwara, N.; Goldman, I.D.; Hourany, E.; Nakamura-Yokota, H.; Reide, F.; Yuasa, T. (Institut de Physique Nucléaire, Université de Paris-Sud, 91 Orsay, France). Phys. Rev. C 12: No. 6, 1974-1977 (Dec 1975).

The ^{3}He breakup induced by a 156 MeV proton beam was studied using a liquid target and the adequate kinematic conditions for *p-p*, *p-n*, and *p-d* quasifree scattering or three nucleon final state interactions. The (*p*, 2*p*) and (*p pn*) differential cross section spectra ($d^3\sigma$) are similar to each other for recoil energy less than 10 MeV and coincide to those calculated with the plane-wave impulse approximation. The $d^3\sigma$ spectrum of the (*p*, *pd*) reaction shows a peak at the minimum *p-d* relative energy indicating their final state interaction. (auth)

18794 ELASTIC DEUTERON–DEUTERON SCATTERING AT LOW BOMBARDING ENERGIES. Niewisch, J. (Erlangen-Nuernberg Univ., Erlangen (F.R. Germany). Physikalisches Inst.); Fick, D. (Max-Planck-Institut fuer Kernphysik, Heidelberg (F.R. Germany)). Nucl. Phys., A; 252: No. 1, 109-119(3 Nov 1975).

The elastic deuteron-deuteron scattering has been measured at theta/sub c.m./ equals 68^0 and 90^0 between E/sub d/ equals 45 keV and 300 keV. A smooth increase of sigma/sigma/sub Mott/ as a function of the bombarding energy is observed for both excitation functions, which can be understood by the interference of the Coulomb with the 1 equals 0, S equals 2 nuclear scattering. The results are discussed in terms of an improved qualitative supermultiplet model of Hackenbroich and Seligmann. (NL)

18795 POLARIZATION IN NEUTRON-PROTON SCATTERING AT 29.6 MeV. Eldred, R.A.; Bonner, B.E.; Cahill, T.A. (Crocker Nuclear Laboratory and the Department of Physics, University of California, Davis, California 95616). Phys. Rev. C 12: No. 6, 1717-1722 (Dec 1975).

The polarization in neutron-proton scattering at 29.6 MeV was deduced from asymmetries measured at every 10° c.m. from 50 to 150° c.m. The incident neutron beam was derived from a high-pressure deuterium gas cell via the ^{2}H(*d*, *n*)^{3}He reaction at 37° c.m. The beam passed through a spin rotation magnet and, at the target location 5.4 m from the gas cell, possessed a flux of 5×10^5 *n*/sec and a polarization of 0.32 ± 0.04. Data between 50 and 110° c.m. were obtained using scintillating CH target in coincidence with neutron detectors, while data between 120 and 150° c.m. were obtained using recoil protons from a CH_2 target. Total errors in the derived polarizations ranged from ± 0.007 to ± 0.022. These data agree very well with three previous values measured near 30 MeV at Los Alamos, but they disagree with Harwell data indicating small or negative polarizations near 150° c.m. The present results agree well with predictions of the Livermore X and Yale IV phase shift sets, but slightly favor the former. (auth)

18796 NEUTRAL CURRENTS IN THERMAL np CAPTURE. Gari, M. (Bochum Univ. (F.R. Germany). Inst. fuer Theoretische Physik); Schlitter, J. (Max-Planck-Institut fuer Chemie (Otto-Hahn-Inst.), Mainz (F.R. Germany). Kernphysikalische Abt.). Phys. Lett., B; 59: No. 2, 118-120(27 Oct 1975).

A calculation is presented of the circular polarization P_γ and asymmetry A_γ of gamma radiation in thermal neutron–proton capture with a tested numerical accuracy of 1%. The effect of neutral currents is discussed on the example of the Weinberg–Salam model of weak interaction. It is also shown that a one percent contribution of the $^3S_1$ scattering state to the regular np capture cross section destroys the favorable isospin selection rule in the polarization. (NL)

18797 PROTON–DEUTERON BACKWARD ELASTIC SCATTERING AT MEDIUM ENERGIES. II. Levitas, M.; Noble, J. V. (Virginia Univ., Charlottesville (USA). Dept. of Physics). Nucl. Phys., A; 251: No. 3, 385-400(27 Oct 1975).

Rescattering corrections to the single-nucleon exchange model of backward p–d elastic scattering are examined and found to be important at all energies. By using realistic deuteron wave functions it is concluded that the rise at E_p(lab) ≃ 400–600 MeV results from another mechanism, possibly the opening of the p + d → NNN*$_{33}$ channel. (NL)

18798 CONFORMAL MAPPING IN THE ENERGY VARIABLE AND NUCLEAR COUPLING CONSTANTS. Locher, M. P. Schweizerisches Inst. fuer Nuklearforschung, Villigen). Nucl. Phys., A; 251: No. 3, 493-501(27 Oct 1975).

Conformal mapping techniques are combined with forward dispersion relations. Applications are made to nα and nd scattering. Legendre and Tchebycheff extrapolations to the nuclear poles lead to consistent values for the ^{4}He^{3}Hen, the dpn and tdn coupling constants. The new method is insensitive to the strength of competing nuclear cuts and to the asymptotic behavior of total cross sections. Cutkosky-type truncation errors can be estimated. (NL)

Nuclear Properties and Reactions, 6 ≤ A ≤ 19

Refer also to abstracts 17223, 18502, 18777, 18779–18782, 18787, 18792, 18794, 18840, 18842, 18849, 18880, 18885, 18895, 18898, 18911–18913, 18924, 19178, 19182, 19184, 19185, 19197, 19225, and 19232.

18799 (BNL-NCS-50446, pp 7-13) TOTAL HELIUM PRODUCTION CROSS SECTION FROM n + ^{10}B INTERACTIONS FOR ENDF/B-IV. Young, P. G.; Hale, G. M. (Los Alamos Scientific Lab., NM). Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

The total neutron-induced alpha production cross section for ^{10}B was derived by summing the cross sections from the reactions (n,alpha$_0$)^{7}Li, (n,alpha$_1$)^{7}Li*(478 keV), and (n,n'alpha)^{6}Li plus twice the reactions (n,t2alpha), (n,n'd2alpha), and (n,2np2alpha). (SDF)

18800 (CEA-CR-2, pp 171-178) INELASTIC SCATTERING OF INTERMEDIATE ENERGY PROTONS. Wilkin, C. [nd]. (In French).

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8-10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

Some aspects of the excitation of discrete levels in nuclei by intermediate energy protons are presented, taking ^{12}C as an example. (FR)

18801 (IPNO-T-75-01) ELASTIC AND INELASTIC PROTON-NUCLEUS SCATTERING AT 156 MeV: EXPERIMENTAL STUDY AND ANALYSIS IN IMPULSE APPROXIMATION. Comparat, V. (Paris-11 Univ., 91 – Orsay (France). Inst. de Physique Nucleaire; Paris-11 Univ., 91 – Orsay (France)). 1975. 109p. (In French). INIS.

In this work a high spatial resolution hodoscope is described. Scattered particles are detected in the image plane of a magnetic spectrometer by a proportional chamber with 96 wires of 1 mm spacing. This hodoscope has been used for elastic and inelastic scattering experiments, of 156-MeV protons, on 11 targets ranging from ^{12}C to ^{209}Bi. A phenomenological optical model calculation has been carried out to analyze the experimental elastic cross section data. The dependence of the parameters as a function of the number of mass or the incident energy has been studied. The inelastic scattering results have been interpreted within the framework of the D.W.I.A. As the final results are dependent of the nucleon model, the optical potential parameters as well as the finite range approximation, several trials have been performed. Nevertheless, the DWIA seems to give about twice the experimental values for collective excitations in light or medium nuclei. The first order optical potential derived from the impulse approximation was calculated and the results compared to the experimental elastic cross sections. Several approximations were tested as non locality, off energy shell effects and the motion of the target nucleon. The usual approximations on these quantities are justified if the momentum transfer is less than 3 fm^{-1}. The nucleon-nucleus transition matrix is obtained by solving the Lippmann-Schwinger equation, using the moment method. The first order optical potential derived from these calculations is not realistic. The intensity of the nucleon-nucleon transition is too important, and that explained the disagreement at low momentum transfers. This study shows that the multiple scattering expansion of the Lippmann-Schwinger equation is not a good method to obtain the exact solution. It is better to do some approximations (i.e., of shell approximation) directly on the integral equation. (FR)

18802 (IPNO-TS-75-2) INELASTIC FORWARD SCATTERING AND α TRANSFER FOR THE $^{16}O + ^{16}O$ SYSTEM. Plagnol, E. (Paris-7 Univ., 75 (France)). 1975. 153p. (In French). Dep. NTIS (US Sales Only) $7.75.

Thesis.

$^{16}O + ^{16}O$ reactions were studied at energies between 50 and 60 MeV and at an angle of 7°. The experimental study had the purpose of verifying that the positions of the structures observed in the transfer path would continue to be invariant even for very small angles and that the absence of structure in inelastic scattering does not come from the energy resolution of preceding studies. A critical study was made of the various optical potentials used to reproduce the cross sections of elastic scattering and a theoretical study was made of the cross sections of the paths close to the elastic path. The study of the optical potentials stresses the effect of the form of the imaginary and real potentials. The role of the potential barrier and its effect on the absorption of peripheral waves was studied in detail. In the study of the reaction paths, a simple model was proposed which coincides satisfactorily with the experimental results. In this model it is assumed that the elements of the reaction matrix can be factorized into three components which depend on the entry path, the l localization (relative angular momentum) of the reaction, and the conditions of the exit path. (JSR)

18803 (ISN-75-17) EXPERIMENTAL STUDY OF GIANT DIPOLE AND QUADRUPOLE RESONANCES IN ^{16}O. Buenerd, M.; Martin, P.; de Saintignon, P.; Loiseaux, J. M. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 1975. 10p. INIS.

The 20-30 MeV excitation energy region of ^{16}O was investigated by inelastic scattering of 45 MeV protons and 60 MeV alpha-particles. E1 and E2 strengths were located. (FR)

18804 (ISN-TS-74-4) A NEW POTENTIAL OF π-NUCLEUS SCATTERING AND ITS APPLICATION TO NUCLEAR STRUCTURE STUDY USING ELASTIC SCATTERING AND CHARGE EXCHANGE REACTIONS. Durand, G. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 France)). 1974. 113p. (In French). INIS.

First the different theories used for studying pion-nucleus scattering and especially Glauber microscopic model and Kisslinger optical model are summarized. From the comparison of these two theories it was concluded that Kisslinger's was better for studying pion-nucleus scattering near the (3/2-3/2) resonance. The potential was developed with a local corrective term proposed by this author. This new term arises from taking into account correctly the Lorentz transformation from the pion-nucleon center of mass to the pion nucleus center of mass system. A coupled-channel formalism was developed allowing the study of pion-nucleus elastic scattering and also the study of single and double charge exchange reactions on nucleus with N > Z. The influence of the new term and the shape of nucleon densities on $\pi^{-12}C$ scattering was studied near 200 MeV. It was found that at the nucleus surface the neutron density was larger than the proton density. On the other hand, a maximum of sensibility to the different nuclear parameters was found near 180 MeV and for elastic scattering angles greater than 100 deg. The calculations of the total cross section for simple and double charge exchange for ^{13}C and ^{63}Cu yielded results similar to those of previous theories and showed the same discrepancy between theory and experiment in the resonance region. (FR)

18805 (ISN-TS-75-3) DOUBLE-STEP PROCESSES IN THE $^{12}C(p,d)^{11}C$ REACTION AT 45 MeV. Couvert, P. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 (France)). 1974. 77p. (In French). INIS.

$^{12}C(p,d)^{11}C$ pick-up reaction was performed with a 45 MeV proton beam. A 130 keV energy resolution was obtained and angular distributions of nine of the ten first levels of ^{11}C have been extracted within a large angular range. Assuming only neutron direct transfer, the strong relative excitation of high spin levels cannot be reproduced by a DWBA analysis. The double-step process assumption seems to be verified by a systematical analysis of the (p,d) reaction mechanisms. This analysis is done in the coupled-channel formalism for the five first negative parity states of ^{11}C. The 3/2-ground state is essentially populated by the direct transfer of a $P_{\frac{3}{2}}$ neutron. The contribution of a double-step process, via the 2^+ inelastic excitation of ^{12}C, is important for the four other states. A mechanism which assumes a deuteron inelastic scattering on the ^{11}C final nucleus after the neutron transfer cannot be neglected and improves the fits when it is taken into account. (FR)

18806 (JUL-1137-KP) MULTIPOLE GIANT RESONANCES AS DOORWAY STATES IN INELASTIC PROTON SCATTERING. Sprickmann, R. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik). Nov 1974. 154p. (In German). Dep. NTIS (US Sales Only) $7.75.

The influence of intermediary structures in the reaction ^{12}C + p was investigated for incident energies of 20 to 50 MeV. In the transitions $O^+_{\frac{1}{2}} \rightarrow O^+_{\frac{1}{2}}$, $O^+ \rightarrow 2^+$, $O^+_{\frac{1}{2}} \rightarrow O^+_{\frac{1}{2}}$, $O^+ \rightarrow 1^+$ T = 0, and $O^+ \rightarrow 1^+$ T = 1, these intermediary resonances were detected qualitatively and quantitatively on the basis of experimental data. In the theoretical part of the study the reaction was derived in the Feshbach projection formalism and discussed completely in its approximation. A detailed analysis was made in the framework of this formalism for the inelastic scattering up to the 1^+ states at excitation energies of 12.71 and 15.11 MeV. No definite assignment on the isospin of the intermediate states was possible in this formalism. The results showed that intermediate structures exist in ^{12}C in the energy range between 20 and 50 MeV. (JSR)

18807 (ORO-4856-26, pp 71-72) STUDY OF THE ALPHA-CLUSTERING STRUCTURE OF ^{20}Ne BASED ON THE RESONATING GROUP METHOD FOR ^{16}O + alpha. Matsuse, T. (Kyoto Univ.); Kamimura, M.; Fukushima, Y. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18808 (ORO-4856-26, pp 73-74) STRUCTURE STUDY OF T equals O LEVELS IN ^{16}O BY ^{12}C + alpha CLUSTER-COUPLING MODEL. Suzuki, Y. (Niigata Univ., Japan). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18809 (ORO-4856-26, pp 75-76) ROLE OF PARTICLE-HOLE INTERACTION IN THE FOUR-PARTICLE-FOUR-HOLE STATES IN ^{16}O. Takada, K.; Tazaki, S. (Kyushu Univ., Fukuoka). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18810 (ORO-4856-26, pp 79-80) ALPHA CLUSTER STRUCTURE OF O^+_2 STATE OF ^{12}C. Uegaki, E. (Hokkaido Univ., Sapporo); Okabe, S.; Abe, Y.; Tanaka, H. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18811 (ORO-4856-26, pp 81-82) ELECTRON SCATTERING FORM FACTORS FOR ^{12}C IN A MOLECULAR-ORBITAL MODEL. Okabe, S. (Hokkaido Univ., Sapparo); Abe, Y. 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18812 (ORO-4856-26, pp 83-84) THREE-ALPHA MODEL OF ^{12}C. Horiuchi, H. (Kyoto Univ.). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18813 (ORO-4856-26, pp 156) MICROSCOPIC CALCULATIONS FOR THE DIFFERENT BEHAVIOR OF THE TWO OXYGEN ISOTOPES ^{16}O AND ^{18}O IN RESPECT TO THE ELASTIC BACKWARD SCATTERING OF alpha PARTICLES. Suenkel, W.; Wildermuth, K. (Univ., Tuebingen, Ger.). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18814 (ORO-4856-26, pp 159) SYMMETRY TEST IN THE REACTIONS t + ^{9}Be yields ^{6}Li + ^{6}He, $^{6}Li^{*}$ (T equals 1) + ^{6}He. von Oertzen, W. (Hahn-Meitner-Institut, Berlin); Flynn, E. 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18815 (ORO-4856-26, pp 162) MULTIPLE SCATTERING CORRECTIONS TO THE p-^{12}C OPTICAL POTENTIAL WITH COHEN-KURATH WAVEFUNCTIONS. Ahmad, K.; Johnson, R. C. (Univ. of Surry, Guildford, Eng.). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18816 (ORO-4856-26, pp 163-164) ROLE OF PARTICLE-EXCHANGE IN THE ^{16}O-alpha SCATTERING STUDIED BY THE RESONATING GROUP TREATMENT. Matsuse, T. (Kyoto Univ.); Kamimura, M.; Fukushima, Y. 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18817 (ORO-4856-26, pp 193-194) EFFECTS OF INTER-CLUSTER EXCHANGE OF PARTICLES ON PHOTONUCLEAR REACTION IN ^{6}Li. Lodhi, M. A. K.; Wood, K. E. (Texas Tech. Univ., Lubbock). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
The bremsstrahlung-weighted cross section for the photodisintegration of ^{6}Li is calculated to study the effect of the exchange of particles between the alpha and deuteron clusters. (auth)

18818 (ORO-4856-26, pp 197-198) STATES OF CARBON-12 BY PROTON SCATTERING FROM BORON-11 (Ep equals 3 ... 8 MeV). Boerchers, F.; Krug, J.; Kamke, D. (Ruhr-Univ., Bochum, Ger.). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18819 (ORO-4856-26, pp 199-200) ALPHA EMISSION FROM SOME EXCITED STATES IN CARBON-12. Krug, J.; Seifert, K. H.; Kamke, D. (Ruhr-Univ., Bochum, Ger.). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
The $^{11}B(p,alpha_1)^{8}Be$ (2.9) reaction is examined in the energy range between 17.2 and 20.6 MeV in order to study some excited states of ^{12}C. (BJG)

18820 (ORO-4856-26, pp 201-202) NARROW POTENTIAL RESONANCES IN LIGHT NUCLEI. Fick, D.; Huther, P.; Kilian, K.; Niewisch, J. (Max-Planck-Institut fuer Kernphysik, Heidelberg). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18821 (ORO-4856-26, pp 230-231) SPIN-ORBIT COUPLING FOR ^{6}Li SCATTERING AND (alpha + d) CLUSTERING. Thompson, W. J. (Univ. of North Carolina, Chapel Hill). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18822 (ORO-4856-26, pp 232-233) MICROSCOPIC STUDY OF alpha-^{6}Li ELASTIC SCATTERING. Remaud, B.; Laskar, W. (Univ., Nantes, France). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
Initial results are presented for theoretical phase shifts for alpha-^{6}Li elastic scattering, calculated using the resonating group method, including a completely antisymmetrized wave function. (auth)

18823 (ORO-4856-26, pp 242-264) SURVEY OF QUASI-FREE CLUSTER KNOCKOUT. Roos, P. G.; Chant, N. S. (Univ. of Maryland, College Park). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
The investigation of quasi-free knockout reactions has been proceeding for many years now, since the first experiments studying (p,2p) reactions on light nuclei. These experiments clearly showed the dominance of quasi-free proton knockout, and have provided information on the proton holes states in nuclei. From very early in the game people extended these studies to the knock-out of clusters, in an attempt to obtain nuclear structure information about clustering in nuclei. These cluster knockout reactions, excluding the nucleon knockout work, are examined. (20 figures, 16 references) (auth)

18824 (ORO-4856-26, pp 295-296) ^{6}Li —GREATER THAN alpha + d VERTEX FROM THE $^{6}Li(p,pd)alpha$ REACTION AT 156 and 590 MeV. Prats, F.; Ghovanlou, A.; Lehman, D. R. (George Washington Univ., Washington, DC). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18825 (ORO-4856-26, pp 305-306) $^{12}C(p,pd)^{10}B$ REACTION AT 75 MeV. Grossiord, J. Y.; Guichard, A.; Gusakow, M.; Pizzi, J. R. (Univ., Lyon). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
An attempt was made to investigate deuteron clustering in nuclei. The excitation spectrum obtained by adding the results of three angular correlations over an energy width of 20 MeV is illustrated. Four states of ^{10}B are observed. (CES)

18826 (ORO-4856-26, pp 307-308) ROLE OF QUASIFREE PROCESSES IN 14.4 MeV NEUTRON-INDUCED MULTIPARTICLE BREAKUP ON LIGHT NUCLEI. Antolkovic, B.; Turk, M. (Institut Rudjer Boskovic, Zagreb). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
An experimental study of the n + ^{6}Li yields alpha + d + n and n + ^{10}B yields alpha + alpha + d + n reactions at 14.4 MeV gave indication on the presence of quasifree (QF) processes. No contribution of the QF process was found in the reaction n + ^{10}B yields alpha + alpha + t. (auth)

18827 (ORO-4856-26, pp 309-310) QUASI-ELASTIC SCATTERING OF 600 MeV PROTONS BY ALPHA CLUSTERS IN LIGHT AND MEDIUM NUCLEI. Anne, R. (CEA, Saclay, France); Delpierre, P.; Devaux, A.; Kahane, J.; Landaud, G.; Sene, R.; Yonnet, J. 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
Alpha knock out from light and medium nuclei up to ^{40}Ca was in-

vestigated. Preliminary values of the differential cross sections (d sigma/d OMEGA$_1$ d OMEGA$_2$ dE) are given for ^{6}Li and ^{12}C nuclei. The P/sub R/ recoil momentum distributions show a maximum at p/sub R/ equals 0. (auth)

18828 (ORO-4856-26, pp 311-312) ANALYSIS OF THE CLUSTER STRUCTURE OF ^{6}Li USING THE (p,p alpha) AND (p,p tau) REACTIONS. Goldberg, D. A.; Roos, P. G.; Chant, N. S.; Woody, R. III. (Univ. of Maryland, College Park). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The cluster structure of ^{6}Li is analyzed using the reactions ^{6}Li(p,p alpha)^{2}H and ^{6}Li(p,p tau)^{3}H. A set of kinematically complete experiments was performed at seven so-called quasi-free angle pairs, i.e., angle pairs for which zero recoil momentum for the residual nucleus is kinematically allowed; data at four such angle pairs was taken for the (p,p alpha) reaction and three for the (p,p tau). The results were analyzed using the impulse approximation. (auth)

18829 (ORO-4856-26, pp 317-318) QUASI-FREE SCATTERING AND REACTION IN ^{7}Li(p,pd)^{4}He, ^{7}Li(p,pt)^{4}He AND ^{7}Li(p,dd)^{4}He REACTIONS AT 100 MeV. Chang, C. C.; Bhowmik, R. (Univ. of Maryland, College Park). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The (p,pd), (p,pt) and (p,dd) reactions on ^{7}Li were studied at E/sub p/ equals 100 MeV. Most of the data were taken with symmetric geometry. A non-symmetric angle pair was chosen which corresponds to zero recoil momentum of the ^{4}He nucleus for both the ^{7}Li(p,pt)^{4}He and ^{7}Li(p,dd)^{4}He reactions. This pair of angles is called the double quasi-free angle. (auth)

18830 (ORO-4856-26, pp 319-320) SPECTROSCOPIC INVESTIGATION OF THE (alpha,2alpha) REACTION. Sherman, J. D.; Hendrie, D. L.; Zisman, M. S. (Univ. of California, Berkeley). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Nine target nuclei ^{12}C, ^{16}O, ^{24,26}Mg, ^{28,30}Si, ^{40,44}Ca, and ^{66}Zn have been studied by the (alpha,2 alpha) reaction with an incident alpha beam energy of 90 MeV. Energy resolution of 250-300 keV (FWHM) permitted identification of many excited states, although the ground state transitions were dominant. The ground state angular correlation cross section magnitudes decreased a factor of ten from ^{12}C to ^{66}Zn. In all cases the data appear to be consistent with a quasifree alpha-alpha collision description of the reaction process. (auth)

18831 (ORO-4856-26, pp 321-322) (alpha,2 alpha) NUCLEAR REACTION AND THE CLUSTER STRUCTURE OF LIGHT NUCLEI. Kudo, Y. (Osaka City Univ.); Honda, T. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

In addition to the ordinary direct knock-out process (DK process) of the (alpha,2 alpha) reaction, the core knock-out process (CK process) is also investigated by the plane wave impulse approximation (PWIA). Numerical calculations are made for the ^{7}Li(alpha,2 alpha)^{3}H reaction of 55 MeV incident energy by taking into account in detail the cluster structure of ^{7}Li. (auth)

18832 (ORO-4856-26, pp 323-324) ^{12}C(alpha,2 alpha)^{8}Be(g.s.) REACTION AT LOW ENERGIES AND THE QUASI-ELASTIC MECHANISM. Cowley, A. A.; Heymann, G. (CSIR, Pretoria). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The reaction ^{12}C(alpha,2 alpha)^{8}Be was studied at energies between 23.3 and 33.5 MeV. The energy dependence of off-energy-shell alpha-alpha cross sections was extracted and compared with theory. The disagreement obtained casts some doubt on previous interpretations of the mechanism of this reaction at low energies. (auth)

18833 (ORO-4856-26, pp 346-347) CHARGED PARTICLE EMISSION FOLLOWING BOMBARDMENT OF NICKEL WITH ^{220}MeV pi$^+$. Amann, J. F.; Barnes, P. D.; Doss, M.; Dytman, S. A.; Eisenstein, R. A.; Penkrot, J.; Thompson, A. (Carnegie-Mellon Univ., Pittsburgh). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

In several recent studies of reactions induced with stopped kaons and pions as well as in-flight pions and protons, the observed singles gamma ray spectra have been discussed in terms of the removal of one or more "alpha clusters". Cross sections for such processes as large as 100 mb have been inferred in some cases for pion bombardment. Recently, calculations of particle evaporation spectra were compared with measured proton induced gamma ray spectra and were brought into agreement only when a pre-equilibrium mechanism was introduced. (auth)

18834 (ORO-4856-26, pp 348-349) gamma RAYS FROM PROTON BOMBARDMENT OF NUCLEI. Artun, O. (CEN, Saclay, France); Cassagnou, Y.; Legrain, R. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Gamma rays from nuclei bombarded by high energy protons (from 100 MeV to 1 GeV) lead to mass distributions of stable nuclei where 4n-nuclei are the most abundant. With calcium an energy dependence is found. Some evidence for direct or semi-direct processes is reported. (auth)

18835 (ORO-4856-26, pp 352-353) CLUSTER ASPECTS OF NUCLEI IN PION-ABSORPTION PROCESSES. Engelhardt, H. D.; Lewis, C. W.; Ullrich, H.; Boschitz, E. T. (CERN, Geneva). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Absorption of stopped negative pions on ^{10}B, ^{16}O, ^{19}F, ^{31}P, ^{40}Ca and ^{93}Nb was investigated by in-beam gamma spectroscopy of residual nuclei. Removal of nucleon numbers compatible with substructures of 3N or alpha-clusters from most targets was found to be comparable in relative yields with that of two-nucleon removal. Removal of (4p,4n) was observed only with Ca and P as target nuclei, these processes being not dominant in contrast to multi-alpha removal reported with Ca as a target at higher pion energies. (auth)

18836 (ORO-4856-26, pp 362) THRESHOLD PION PRODUCTION IN PION-NUCLEUS COLLISIONS: A SIMPLE ESTIMATE. Rockmore, R. (Rutgers-the State Univ., New Brunswick, NJ). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18837 (ORO-4856-26, pp 367-391) NUCLEAR SPECTROSCOPY WITH MULTINUCLEON TRANSFER. von Oertzen, W. (Hahn-Meitner-Institut fuer Kernforschung, Berlin). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

In this survey attention is focused on specific problems and successes encountered in multinucleon transfer. The subject is divided into four sections: two-nucleon transfer, three-nucleon transfer, four-nucleon transfer, and alpha-particle reactions involving ^{6}Li or ^{7}Li in the initial or final channel. 20 figures, 33 references. (BJG)

18838 (ORO-4856-26, pp 392-406) RECENT MULTINUCLEON TRANSFER EXPERIMENTS WITH HEAVY IONS AT BERKELEY. Harvey, B. G. (Univ. of California, Berkeley). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

A review of two-, three-, four-, and multi-nucleon transfer reaction experiments at Berkeley and their relation to clustering is given. 13 figures, 23 references. (BJG)

18839 (ORO-4856-26, pp 413-414) ALPHA-PARTICLE PICK-UP REACTIONS IN THE 1p AND 1d2s SHELLS. Molen, A. V.; Janecke, J.; Becchetti, F. D. (Univ. of Michigan, Ann Arbor). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The ^{12}C(d,^{6}Li)^{8}Be, ^{16,18}O(d,^{6}Li)^{12,14}C, ^{20,22}Ne(d,^{6}Li)^{16,18}O and

$^{40}Ca(d,^{6}Li)^{36}Ar$ reactions have been studied at E/sub d/ equals 35 MeV. The results are in good overall agreement with simple SU_3 shell-model predictions. (auth)

18840 (ORO-4856-26, pp 415-416) STUDY OF ^{16}O WITH FOUR-PARTICLE TRANSFER REACTIONS. Pilt, A. A.; Cornell, J. C.; Fisher, P. S.; Menchaca-Rocha, A.; Millener, D. J.; Sinclair, D.; Scott, D. K. (Oxford Univ.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Levels in ^{16}O have been studied with the four-particle transfer reactions $^{12}C(^{11}B,^{7}Li)^{16}O$, $^{12}C(^{12}C,^{8}Be)^{16}O$, $^{12}C(^{16}O,^{12}C)^{16}O$ and $^{12}C(^{20}Ne,^{16}O)^{16}O$ using high energy (approximately 110 MeV) heavy ion beams from the Harwell VEC. The reaction products were detected and identified with counter telescopes, giving typically 600 keV overall resolution. (auth)

18841 (ORO-4856-26, pp 419-420) (p,^{6}Li) NUCLEAR REACTION AND CLUSTER STRUCTURE OF LIGHT NUCLEI. Kudo, Y. (Osaka City Univ.); Honda, T.; Horie, H. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Differential cross sections for the (p,^{6}Li) reactions for the target nuclei ^{11}B, ^{12}C, ^{16}O and ^{19}F have been measured at an incident proton energy of 52 MeV using the INS-Tokyo FM cyclotron.

18842 (ORO-4856-26, pp 421-422) $^{12}C(^{14}N,^{13}C)^{13}N(2.37, 1/2^{+})$ AND $^{12}C(^{10}B,^{9}Be)^{13}N(2.37,1/2^{+})$ REACTIONS AND THE STRUCTURE OF THE 2.37 MeV STATE IN ^{13}N. Nair, K. G.; Hamm, M.; Towsley, C.; Nagatani, K. (Texas A and M Univ., College Station). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Heavy ion induced proton transfer reactions are used to populate low-lying levels in ^{13}N. Angular distributions to the 2.37 MeV state in ^{13}N show anomalies which perhaps may be due to possible collective components in this previously assumed pure single particle 2s/sub $1/2$/ orbit. (auth)

18843 (ORO-4856-26, pp 423-424) CLUSTER ASPECTS OF MULTINUCLEON TRANSFER REACTIONS. Nair, K. G.; Hamm, M.; Towsley, C. W.; Hanus, R.; Nagatani, K. (Texas A and M Univ., College Station). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Three- and four-nucleon transfer reactions in light elements induced by high energy ^{14}N and ^{10}B beams are investigated with a view to extracting spectroscopic information on cluster states. The high selectivity for populating states with predominant cluster structure in the residual nuclei for these reactions is emphasized. (auth)

18844 (ORO-4856-26, pp 425-426) DIRECT 5-NUCLEON-TRANSFER IN THE REACTIONS ^{10} $^{11}B(^{14}N,^{9}Be)^{15}$ ^{16}O AND $^{13}C(^{14}N,^{9}Be)^{18}F$. Klapdor, H. V.; Reiss, H.; Rosner, G.; Schrader, M.; Ford, J. L. C. Jr.; Thornton, S. T. (Max-Planck-Institut fuer Kernphysik, Heidelburg). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18845 (ORO-4856-26, pp 427-428) DOUBLE EXCHANGE OF PARTICLES IN HEAVY ION REACTIONS. Pham, D. L. (Institut de Sciences Nucleaires, Grenoble, France). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

A model is presented to study a reaction where there are particles transferred simultaneously from the projectile to the target as well as from the target to the projectile. The $^{12}C(^{6}Li,^{8}He)^{13}N$ reaction at E/sub L/ equals 31.8 MeV is taken as an example and good agreement with the data is obtained. (auth)

18846 (ORO-4856-26, pp 429-430) (p,alpha) REACTIONS ON LIGHT NUCLEI. Buck, W.; Schenk, K.; Staebler, A.; Staudt, G. (Univ., Tuebingen, Ger.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

As part of a program to study the mechanism of (p,alpha) reactions on light nuclei, angular distributions and excitation functions of the reactions $^{6}Li(p,^{3}He)^{4}He$, $^{11}B(p,alpha)^{8}Be$ and $^{19}F(p,alpha)^{16}O$ have been investigated from E/sub p/ equals 6 to 20 MeV. The experiments have been done at the tandem accelerators in Erlangen and Heidelberg. (auth)

18847 (ORO-4856-26, pp 431-432) $^{16}O(alpha,p)^{19}F$ AND $^{12}C(alpha,p)^{15}N$ REACTIONS AT E/sub alpha/ equals 40 MeV. van der Woude, A.; van der Borg, K.; de Meijer, R. J. (Univ., Groningen, Netherlands). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The $^{16}O(alpha,p)^{19}F$ and $^{12}C(alpha,p)^{15}N$ reactions at E/sub alpha/ equals 40 MeV are studied with the analyzed beam of the K.V.I. cyclotron. Representative spectra at THETA/sub L/ equals 15^{0} are shown in Fig. 1. The selectivity of the reaction is clearly demonstrated: In both reactions only a few levels at high excitation energies are strongly excited. (auth)

18848 (ORO-4856-26, pp 433-434) CLUSTER STRUCTURE OF THE ^{9}Be NUCLEUS FROM THE $^{9}Be(n, alpha)^{6}He$ REACTION. Smolec, W.; Burzynaski, S.; Rusek, K.; Turkiewicz, I.; Turkiewicz, J.; Zupranski, P. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18849 (ORO-4856-26, pp 435-436) ANGULAR CORRELATION STUDY OF SOME ^{16}O HIGHLY EXCITED LEVELS. Foti, A. (Instituto di Fisica Nucleare, Cantania, Italy); Pappalardo, G.; Stazzeri, A.; Avril, M.; Lepareux, M.; Saunier, N. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Spin, parity and alpha-decay properties of some ^{16}O highly excited levels (at 16.3, 20.9, and 21.8 MeV) have been measured by means of the particle-particle angular correlation method applied to the $^{12}C(^{6}Li,d)^{16}O^{*}$ yields alpha + ^{12}C reaction; the deuterons were detected at 0° by means of a magnetic spectrometer. (auth)

18850 (ORO-4856-26, pp 524-525) STUDY OF THE $^{12}C(alpha,^{8}Be)^{8}Be$ REACTION. Brochard, F.; Chevallier, P.; Disdier, D.; Rauch, V.; Rudolf, G.; Scheibling, F. (Centre de Recherches Nucleaires, Strasbourg). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The $^{12}C(alpha,^{8}Be)^{8}Be$ reaction has been studied in the energy range E/sub alpha/ equals 27–33 MeV. Analysis of angular distributions measured from E/sub alpha/ equals 12.5 MeV to 33 MeV allows the extraction of the total cross section corresponding to the dominant l. Hauser–Feshbach calculations may explain the large structures observed. (auth)

18851 (ORO-4856-26, pp 526-527) RESONANCES IN THE $^{12}C + ^{12}C$ SYSTEM. Castro, J. J.; Federman, P. (Instituto Politecnico Nacional, Mexico City). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18852 (ORO-4856-26, pp 530-531) SPIN ASSIGNMENT OF J/sup pi/ equals 12^{+} FOR THE $^{12}C + ^{12}C$ RESONANCE AT E/sub ^{12}C/(c.m.) equals 18.5 MeV. Bernhardt, K. G. (Univ. of Washington, Seattle); Eberhard, K. A.; Weidinger, A. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept of Physics and Astronomy).

In an effort to obtain a more precise picture of the recently observed resonances in excitation functions for $^{12}C(^{12}C,alpha)^{20}Ne$, $^{10}B(^{14}N,alpha)^{20}Ne$ and $^{12}C(^{12}C,^{8}Be)^{16}O$ at excitation energies in the region of 30 to 40 MeV in the corresponding compound nucleus ^{24}Mg, angular distributions in this energy range have been measured for the $^{12}C(^{12}C,^{8}Be)^{16}O$ reaction. (auth)

18853 ORO-4856-26, pp 532-533) STUDY OF MOLECULAR RESONANCES IN ^{12}C–^{12}C AND ^{12}C–^{16}O SCATTERINGS BY IMANISHI MODEL. Kondo, Y.; Matsuse, T.; Abe, Y. (Kyoto Univ.). 1975

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18854 (ORO-4856-26, pp 540-541) RESONANCES IN INELASTIC $^{12}C + ^{16}O$ SCATTERING. Malmin, R. E.; Paul, P. (SUNY, Stony Brook, NY). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18855 $^{12}C + \alpha \rightarrow 4\alpha$ REACTION. Klyucharev, A. P.; Rutkevich, N. Ya.; Kuzmichev, M. A.; Linetskii, A. R. (Physical-Technical Inst., Kazan). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1527-1531(Aug 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1719-1723(Aug 1970).
In the present work we investigated the $^{12}C + \alpha \rightarrow 4\alpha$ reaction at an incident α-particle energy E_α of about 37 MeV. Thick nuclear emulsions were used as both target and detector so one could determine all the parameters of the four-prong stars. Energy spectra, correlation angles, and the excitation function are shown and their implications for various reaction mechanisms are discussed. (auth)

18856 α-PARTICLE SPECTRUM OF ^{6*}He. Abramovich, S. N.; Morkin, L. A.; Pereshivkin, V. A.; Serov, V. I. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1532-1534(Aug 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1724-1726(Aug 1970).
The aim was to explore the possibility of using an experiment on the three-particle decay of ^{6*}He to determine the scattering length a_{nn} and to study the mechanism of the three-particle decay in ^{3}H reactions on ^{7}Li. The experiment was performed at a triton energy of 2 MeV. While present accuracy does not allow one to draw an unambiguous conclusion on the N-N scattering length, one can conclude that this value is less than −10 fermi. (JFP)

18857 COMPLEX POTENTIAL MODEL FOR RESONANCES IN DEUTERON SCATTERING BY NUCLEI. Sokolov, L. S.; Kabakova, N. E. (Kiev State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1926-1929(Oct 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2159-2162(Oct 1970).
The cross sections for elastic scattering of low energy deuterons from light nuclei depend on energy in an intricate manner. For specific even-even target nuclei, nearly separated resonances with widths of tens and hundreds of keV are observed. These resonances were analyzed using the Breit-Wigner dispersion formula to obtain widths for elastic scattering and inelastic processes (Γ_e and Γ_r) and the formal resonance energies E_0. This procedure is equivalent to phase analysis and yields no information on the nuclear interaction. The resonances are analyzed starting not from the phases, but from the potential. This may be justified on the grounds that Schroedinger's equation must always hold. Formulas are derived for the widths in terms of the potential, and the potential parameters are discussed. One can obtain the observable widths Γ_e and Γ_r. The elastic scattering of deuterons by carbon-12 is considered. (JFP)

18858 THEORY OF THE (^{6}Li,d) AND (^{7}Li,t) REACTIONS. Dolinskii, E. I.; Turovtsev, V. V.; Yarmukhamedov, R. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1952-1955(Oct 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2188-2191(Oct 1970).
The results of an analysis of experimental data on the angular distributions of reaction products from the (^{6}Li,d) and (^{7}Li,t) reactions on ^{12}C and ^{16}O is presented. The analysis is based on the peripheral model for direct processes. (JFP)

18859 DETERMINATION OF THE SPIN AND PARITY OF THE 26.9 MeV STATE OF ^{12}C. Komarov, V. V.; Salman, H. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1500-1502(Aug 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1689-1690(Aug 1970).
The levels of ^{8}Be (2^+) appearing as the interaction of the alpha particles from ^{11}B(p,3α) at E_p = 1.4 MeV, the detected α particles escaping at 95° in the laboratory system are shown. The ^{12}C decays from the 1^- level, and the spectrum of the alpha particles from ^{10}B(d,3α) at E_d = 1.9 MeV and $\theta_{\alpha\alpha}$ = 124° in the laboratory system for ^{12}C breaking up from the 26.9-MeV state are shown. It was found that the most likely spins and parities for states of the ^{12}C compound nucleus at 26.9 MeV are 0, 1^-, 1^+, 2^-, 2^+. Calculated differential cross section curves for alpha-particle formation with the given characteristics for the 26.9-MeV-state for carbon-12 are also shown. (JFP)

18860 QUASI-FREE ELECTRON SCATTERING ON α-PARTICLES AND DEUTERONS IN ^{6}Li AND ^{9}Be. Genin, J. P. (Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette, France); Julien, J.; Rambaut, M.; Samour, C.; Palmeri, A.; Viciguerra, D. Lett. Nuovo Cim.; 13: No. 18, 693-696(30 Aug 1975).
Two measurements are reported extending previous data by changing the momentum transfer for the ^{6}Li(e,e'α) and ^{6}Li(e,e'd) reactions and by investigating the ^{9}Be(e,e'α) reaction all at 515 to 556 MeV. Missing-mass spectra and parameters for the coincidence cross sections of the fitting curves for the studied reactions are found and discussed. (JFP)

18861 INVESTIGATION OF THE REACTION ^{9}Be(d,t_0)^{8}Be IN THE DEUTERON ENERGY RANGE 0.9 TO 2.5 MeV. Bondouk, I. I.; Asfour, F.; Machali, F. (Atomic Energy Establishment, Cairo). Ann. Phys. (Leipzig); 32: No. 4, 255-260(Jun 1975).
The reaction ^{9}Be(d,t_0)^{8}Be was investigated in the deuteron energy range 0.9 to 2.5 MeV. The excitation functions were measured at laboratory angles 45 and 120° and showed no sharp resonances. The angular distributions (differential cross sections in mb/sr) were measured in 200-keV intervals. An analysis of the data was made using the Butler and the distorted wave theories. (auth)

18862 TRANSFER OF NEUTRON−PROTON PAIRS IN HEAVY-ION INTERACTIONS. Poth, J. E.; Sachs, M. W.; Bromley, D. A. (Yale Univ., New Haven). Nuovo Cim.; 28A: No. 2, 215-239(21 Jul 1975).
Neutron-proton transfer reactions have been studied on ^{12}C, ^{13}C, ^{14}N, ^{15}N, ^{16}O and ^{20}Ne targets in the (^{11}B, ^{9}Be) reaction induced by 116 MeV ^{11}B ions. The reactions are characterized by a high degree of selectivity, and evidence has been obtained for a particularly simple direct mechanism involving simultaneous surface transfer of the nucleon pair. The T = 1 reaction channel is significantly inhibited, and the reaction spectra and angular distributions are similar to those of the corresponding α-particle-induced neutron-proton transfer reactions. DWBA calculations including finite range and full recoil reproduce the observed angular distributions, and a Hauser-Feshbach analysis confirms the dominant direct character of these reactions. (auth)

18863 FRAGMENTATION OF ACCELERATED 2.1 GeV/NUCLEON ^{12}C, ^{14}N, AND ^{16}O IONS IN NUCLEAR EMULSION. Medina, J. (Univ., Barcelona); Dura, A.; Fernandez, F.; Sequeiros, J.; Tomas, M.; Bolta, J. M.; Ramon, J. L.; Kaiser, R. Nuovo Cim.; 28A: No. 3, 297-304(1 Aug 1975).
The inelastic-interaction mean free path and fragmentation parameters in nuclear emulsion of accelerated 2.1 GeV/nucleon ^{12}C, ^{14}N and ^{16}O have been determined. The discrimination of the targets has been achieved with a new method. The global results obtained for the three ions have been compared with the M-group of the cosmic radiation. (auth)

18864 ROLE OF EFFECTIVE TWO-NUCLEON POTENTIAL IN THE ELECTRIC MONOPOLE TRANSITION IN ^{12}C AND ^{16}O. Nguyen, T. N. (Charles Univ., Prague). Czech. J. Phys.; 25: No. 10, 1119-1126(1975).
The Shiff's model is used to explain the 0^+-transition mechanism in nuclei. In contrary to the Shiff's study more realistic effective potentials suggested by Siemens and Sprung and Banerjee are applied. They give good results. (auth)

18865 PHOTODISINTEGRATION OF ^{13}C THROUGH EXCITED STATES ^{12}C AND ^{12}B. Patrick, B. H. (Atomic Energy Research Establishment, Harwell, Eng.); Bowey, E. M.; Winhold, E. J.; Reid, I. M.; Muirhead, E. G. J. Phys., G (London); 1: No. 8, 874-894(21 Oct 1975).
Gamma ray spectra from the reactions ^{13}C(γ, nγ') and ^{13}C(γ, pγ') have measured simultaneously in a Ge(Li) detector at 112° using bremsstrahlung with end-point energies in the range 15 to 44 MeV in order to study the decay of the ^{13}C giant resonance through excited states of the residual nuclei. The cross sections for neutron emission to the 4.44 and 15.1 MeV states in ^{12}C and for proton emission to the 0.95 MeV state in ^{12}B have been measured. The integrated ^{13}C(γ, 2n) cross section up to 40 MeV has been determined and found to be very small in comparison with the (γ, n)

cross section. The (γ, n) and (γ, p) cross sections for feeding the ground states and also certain excited states which do not decay by γ emission have been deduced. The cross sections are compared with other measurements and theoretical calculations. The structure of the ^{13}C giant resonance is discussed. The results support the evidence for isospin splitting of the giant resonance as predicted in a number of theoretical calculations. (auth)

18866 CONFIGURATION INTERACTION AND ROTATIONAL STRUCTURE IN ^{8}Be. Arickx, F.; van Leuven, P. (Rijksuniversitair Centrum te Antwerpen (Belgium)); Bouten, M. (Limburgs Universitair Centrum (Belgium)). Nucl. Phys., A; 252: No. 2, 416-422(10 Nov 1975).

A configuration interaction calculation for ^{8}Be is carried out in which $0(\hbar/2\pi)\omega$, $2(\hbar/2\pi)\omega$ and $4(\hbar/2\pi)\omega$ configurations are taken into account. The results indicate a reordering of levels into new rotational bands and a grouping of bands into "families". (NL)

18867 THREE-NUCLEON TRANSFER ON ^{12}C: THE $^{12}C(\alpha,p)^{15}N$ REACTION AT 96.8 MeV. Falk, W. R.; Djaloeis, A.; Ingham, D. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Kernphysik). Nucl. Phys., A; 252: No. 2, 452-476(10 Nov 1975).

Angular distributions of protons from the $^{12}C(\alpha,p)^{15}N$ reaction have been measured over the angular range from 10 to 70° at an α-particle bombarding energy of 96.8 MeV. Well-defined particle groups were observed up to an excitation energy of 18 MeV in ^{15}N. The relatively small number of states excited implies a selectivity both in the reaction mechanism and in structure effects. DWBA calculations using a semi-microscopic three-nucleon form factor have been performed using several different sets of wave functions. Good agreement in the ratio $\sigma_{exp}\sigma_{th}$ is obtained for most states by using the ^{15}N wave functions of de Meijer. The strongest state in the (α,p) spectrum was observed at 15.397 MeV in ^{15}N, and DWBA calculations give good agreement for a $13/2^+$ assignment. This state has been observed only in other three-nucleon transfer reactions involving heavy ions. The recent discovery of a $9/2^+$ state at 10.693 MeV in a p + ^{14}C resonance measurement is supported by the analysis. (NL)

18868 ELECTROEXCITATION OF THE 0^+ (3.562 MeV) LEVEL OF ^{6}Li AND ITS APPLICATION TO THE REACTION $^{6}Li(\gamma,\pi^+)^{6}He$. Bergstrom, J. C.; Auer, I. P.; Hicks, R. S. (Saskatchewan Univ., Saskatoon (Canada). Saskatchewan Accelerator Lab.). Nucl. Phys., A; 251: No. 3, 401-417(27 Oct 1975).

The M1 form factor for the 0^+ (3.562 MeV, T = 1) level in ^{6}Li has been measured in the momentum transfer range q = 0.26 to 1.15 fm^{-1}. The radiative width is found to be $\gamma_{\gamma 0} = 8.16 \pm 0.19$ eV by extrapolation to the photon point. Phenomenological configuration amplitudes have been obtained for the ground and 3.562-MeV level, and it is shown that the 1p harmonic oscillator radial wave functions do not give a good description of the inelastic form factor. The results have been applied to the reaction $^{6}Li(\gamma,\pi^+)^{6}He$ near threshold. The theoretical cross section is 24% higher than the data. The muon capture rate in ^{6}Li and $F_A(0)$ are also evaluated . (NL)

18869 SEMI-LEPTONIC WEAK AND ELECTROMAGNETIC INTERACTIONS IN THE GOLDHABER–TELLER MODEL. Donnelly, T. W.; Dubach, J.; Haxton, W. C. (Stanford Univ., Calif. (USA). Inst. of Theoretical Physics). Nucl. Phys., A; 251: No. 3, 353-384(27 Oct 1975).

The Goldhaber–Teller model is employed in an investigation of semi-leptonic weak and electromagnetic excitations in a series of doubly even light nuclei. Electron scattering, a comprehensive set of weak interactions (μ^-capture, β-decay, neutrino-induced reactions, muon-induced reactions) with particular emphasis on the identification of second-class tensor current effects, and inelastic neutrino scattering via neutral current interactions are examined. (NL)

18870 EXCHANGE CORRECTIONS TO THE ALLOWED β-DECAY OF THE A = 15, 17, 39, and 41 MIRROR NUCLEI. Barroso, A.; Blin-Stoyle, R. J. (Sussex Univ., Brighton (UK). School of Mathematical and Physical Sciences). Nucl. Phys., A; 251: No. 3, 446-456(27 Oct 1975).

A calculation is made of the mesonic exchange corrections to the allowed axial vector mirror β-decays $^{15}O \rightarrow {}^{15}N$, $^{17}F \rightarrow {}^{17}O$, $^{39}Ca \rightarrow {}^{39}K$ and $^{41}Sc \rightarrow {}^{41}Ca$. It is found that the corrections are significantly state dependent and can be both positive and negative. (NL)

18871 TOTAL NUCLEAR PHOTON ABSORPTION CROSS SECTIONS FOR SOME LIGHT ELEMENTS. Ahrens, J.; Borchert, H.; Czoch, K. H.; Eppler, H. B.; Gimm, H.; Gundrum, H.; Kroening, M.; Riehn, P.; Sita Ram, G.; Zieger, A. (Max-Planck-Institut fuer Chemie (Otto-Hahn-Inst.), Mainz (F.R. Germany). Kernphysikalische Abt.). Nucl. Phys., A; 251: No. 3, 479-492(27 Oct 1975).

Absolute nuclear photon absorption cross sections have been measured for the elements Li, Be, C, O, Al, Si and Ca from 10 MeV up to photon energies beyond the meson production threshold. Magnetic Compton spectrometers and a bremsstrahlung spectrum with fixed end-point energy were used. The cross sections show structure in the region of the giant resonance and fall off smoothly towards higher energies. In the giant resonance region recent 1p–1h calculations are in poor agreement with these measurements except for one calculation for carbon, which included low-lying excited states of the residual mass-11 system. The cross section in the intermediate region (40 to 140 MeV) can be described by the quasi-deuteron model with the density of deuteron-like structures taken as 8 NZ/A. The moments of the measured cross sections are compared with sum rule predictions. The integrated cross sections from 10 MeV up to the meson production threshold (140 MeV) exceed the classical dipole sum by a factor of 1.4 to 2. (NL)

18872 6.324-MeV HOLE STATE IN ^{15}N. Moreh, R.; Shahal, O. (Nuclear Research Centre, Negev, Beer-Sheva, Israel). Nucl. Phys., A.; 252: No. 2, 429-436(10 Nov 1975).

The 6.324-MeV level of ^{15}N was photoexcited by a chance energy overlap with a γ line obtained from the Cr(n,γ) reaction using thermal neutrons. By measuring the angular distribution of the scattered radiation and its polarization, the spin and parity of the level was determined to be $J^\pi = 3/2^-$. The E2/M1 mixing ratio of the $3/2^- \rightarrow 1/2^-$ ground-state transition was unambiguously determined to be $x(E2/M1) = 0.137 \pm 0.005$. An upper limit to the branching ratio of the decay of the level to lower lying levels in ^{15}N was obtained. The radiative width of the level was also measured and found to be $\gamma = 3.1 \pm 0.3$ eV. The result is compared with theoretical predictions. (NL)

18873 ENERGY-DEPENDENT ANISOTROPY OF BETA-RAYS AND SECOND-CLASS CURRENTS. Kubodera, K. (Tokyo Univ. (Japan). Dept. of Physics); Horikawa, Y. (Juntendo Univ., Tokyo (Japan). School of Medicine). Phys. Lett., B; 58: No. 4, 402-404 (29 Sep 1975).

Sugimoto, Tanihata and Goring's experimental data on the energy dependence of the asymmetries of beta rays emitted from polarized ^{12}B and ^{12}N nuclei are analyzed in an almost nuclear model independent way. The analysis suggests the existence of second-class currents. New limits on KDR's second-class current parameters ξ and λ are estimated. (NL)

18874 EXCHANGE EFFECTS IN THE SCATTERING OF α-PARTICLES AND DEUTERONS BY ^{6}Li. Goldberg, V. Z.; Gridnev, K. A.; Hefter, E. F.; Novatskii, B. G. (Gosudarstvennyj Komitet po Ispol'zovaniyu Atomnoj Ehnergii SSSR, Moscow. Inst. Atomnoj Ehnergii). Phys. Lett., B; 58: No. 4, 405-407(29 Sep 1975).

Optical-model parameters are extracted from the elastic scattering of α particles at 36.6 MeV and of deuterons at 19.6 MeV on ^{6}Li. These optical-model fits do not reproduce the observed maximum at backward angles. Thus, a DWBA calculation has been included in which the d- or α-exchange pole graphs are treated as the (small) transitions potential and the distortion is induced in incident and exit channels by the optical potential which fits the forward scattering. (NL)

18875 RADIATIVE WIDTH FOR THE 10.35–6.92 MeV TRANSITION IN ^{16}O. Chew, S. H.; Lowe, J. (Birmingham Univ. (UK). Dept. of Physics). Nucl. Phys., A; 252: No. 1, 8-12(3 Nov 1975).

From a measurement of the cross section for $^{12}C(\alpha,\gamma)^{16}O$ at the $E_\alpha = 4.253 \pm 0.014$ MeV ($E_x = 10.352 \pm 0.011$ MeV) resonance, the radiative width for the 10.35 MeV ($J^\pi = 4^+$) to 6.92 MeV ($J_\pi = 2^+$) transition was determined to be $\gamma = 58 \pm 7$ meV. This is somewhat higher than the value predicted by large j–j shell-model calculations, but agrees well with predictions based on the rotational and the SU(3) models for a 4p–4h band, and the deformed basis calculation of Green and Brown. (NL)

18876 (^{9}Be, ^{8}B) REACTION AND THE UNBOUND NUCLIDE ^{10}Li. Wilcox, K. H.; Weisenmiller, R. B.; Wozniak, G. J.; Jelley, N. A.; Ashery, D.; Cerny, J. (California Univ., Berkeley (USA). Lawrence Berkeley Lab.). Phys. Lett., B; 59: No. 2, 142-144 (27 Oct 1975).

Counter-telescope and recoil-coincidence techniques were employed to study the $^{9}Be(^{9}Be,^{8}B)^{10}Li$ reaction at 121 MeV. A cross section of approximately 30 nb/sr (c.m.) was observed, and a ^{10}Li mass excess of 33.83 +– 0.25 MeV was indicated. This corresponds to ^{10}Li being unbound to ^{9}Li + n by 0.80 +– 0.25 MeV. (NL)

18877 ^{6}Li(alpha,2 alpha)^{2}H REACTION AT 700 MeV AND THE alpha-d MOMENTUM DISTRIBUTION. Dollhopf, W.; Perdrisat, C. F. (College of William and Mary, Williamsburg, Va. (USA).

Dept. of Physics); Kitching, P.; Olsen, W. C. (Alberta Univ., Edmonton (Canada). Nuclear Research Centre). Phys. Lett., B; 58: No. 4, 425-427(29 Sep 1975).

The results of an experimental study of the reaction ^{6}Li (alpha,2 alpha)^{2}H at 700 MeV are given. A comparison with the data from seven other reactions pertaining to the alpha + d cluster structure of ^{6}Li is presented. The amplitude for the virtual transition ^{6}Li yields alpha + d obtained in three of these experiments and the present one are comparable. The internal momentum distributions extracted with the plane-wave impulse approximation in four of the experiments are compatible with a pole form, the width parameter being given by the alpha-separation energy in ^{6}Li. The remarkable consistency among these results is seen as evidence for the validity of the simple models used for both the reaction mechanism (PWIA) and the alpha–d vertex (pole approximation) in ^{6}Li. (NL)

18878 ABSOLUTE CROSS SECTIONS FOR PION REACTIONS ON LIGHT NUCLEI AT THE (3,3) RESONANCE. Karol, P. J.; Yester, M. V.; Klobuchar, R. L.; Caretto, A. A. Jr. (Carnegie-Mellon Univ., Pittsburgh, Pa. (USA). Dept. of Chemistry). Phys. Lett., B; 58: No. 4, 489-490(29 Sep 1975).

Absolute cross sections for pion-induced neutron knockout reactions and some more complex reactions on ^{14}N, ^{16}O, ^{19}F and ^{31}P were determined by activation at 190 MeV. Results are consistent with existing spallation models as modified by the recent final-state interaction theory of Sternheim and Silbar. (NL)

18879 EXCITATION FUNCTIONS OF THE REACTION ^{12}C + ^{13}C. Haindl, E.; Galster, W.; Dück, P.; Treu, W.; Siller, F.; Voit, H. (Physikalisches Institut der Universität Erlangen-Nürnberg, Erlange, West-Germany). Phys. Rev. Lett. 35: No. 21, 1478-1480 (24 Nov 1975).

Excitation functions have been measured for the α-particle, proton, and elastic channels of the reaction ^{12}C+^{13}C at several angles in the energy range E_{lab}=16–28 MeV. Observed structures cannot be due to molecular-type doorway states as is the case for the sub-Coulomb resonances of the reaction ^{12}C+^{12}C. (auth)

18880 ASYMMETRY OF MIRROR γ DECAYS IN ^{13}C AND ^{13}N. Kurath, D. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. Lett. 35: No. 22, 1546-1547 (1 Dec 1975).

An explanation is offered for the large difference in B ($E1$) values of mirror transitions from 1/2$^+$ state to the ground state, based on the difference in binding energy of the 1/2$^+$ states. The binding energy determines the degree of coupling of the positive parity nucleon to the deformed ^{12}C core, which in turn affects the B ($E1$) value. The experimental asymmetry can be satisfied with a small change of the wave function. (auth)

18881 EXPERIMENTAL STUDY OF WEAK MAGNETISM AND SECOND-CLASS INTERACTION EFFECTS IN THE β DECAY OF POLARIZED ^{19}Ne. Calaprice, F.P.; Freedman, S.J.; Mead, W.C.; Vantine, H.C. (Department of Physics, Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540). Phys. Rev. Lett. 35: No. 23, 1566-1570 (8 Dec 1975).

The angular distribution of positrons emitted in the decay of polarized ^{19}Ne has been measured as a test for the second-class weak interaction. The β asymmetry parameter varies linearly with the β energy with slope $(dA/dE)_{exp}$= (-0.65 ± 0.15) % MeV^{-1}. This result requires a second-class form factor comparable to the weak-magnetism term. (auth)

18882 INVESTIGATION OF GIANT RESONANCES AS DOORWAY STATES IN INELASTIC NUCLEON SCATTERING FROM ^{12}C. Geramb, H.V.; Amos, K. (Institut für Kernphysik, Kernforschungsanlage, Jülich, West Germany); Sprickmann, R.; Knöpfle, K.T.; Rogge, M.; Ingham, D.; Mayer-Böricke, C. Phys. Rev. C 12: No. 6, 1697-1710 (Dec 1975).

A formalism for inelastic nucleon scattering from nuclei is developed which takes into account explicitly the effect of giant multipole resonance states. The transition amplitudes derived from this formalism, when energy averaged, separate into two primary components. The first is the slowly energy varying direct reaction amplitude that is mediated by an effective interaction while the second is the energy varying semidirect reaction amplitude associated with doorway state excitations of giant resonances. The determination of quantum numbers and associated properties of giant resonances follow from analyses of inelastic nucleon scattering to low lying nuclear states. Specifically, from the application to the inelastic scattering of 23 to 45 MeV protons from ^{12}C leading to the 1$^+$ (12.71 MeV $T=0$ and 15.1 MeV $T=1$) states, the strength distributions of the giant isovector $E1$ and isoscalar $E2$ and $E3$ resonances are determined. (auth)

18883 HOW IMPORTANT ARE TWO-STEP PROCESSES IN ^{16}O(^{3}He, d)^{17}F?. Fortune, H.T.; Medsker, L.R.; Garrett, J.D.; Bingham, H.G. (Physics Department, University of Pennsylvania, Philadelphia, Pennsylvania 19174). Phys. Rev. C 12: No. 6, 1723-1725 (Dec 1975).

Angular distributions were measured for the ^{16}O(^{3}He, d)^{17}F reaction leading to the first four states of ^{17}F. Comparison with distorted-wave Born-approximation (DWBA) calculations yields spectroscopic factors of 0.94 and 0.83 for the ground and first-excited states, respectively. Comparison with unbound DWBA predictions calculated from the known proton widths of the next two states indicates the presence of a large two-step component for population of the 1/2$^-$ state and possibly of the 5/2$^-$ state. (auth)

18884 ANGULAR DISTRIBUTION MEASUREMENTS FOR ^{14}C(d, p)^{15}C AND THE LEVEL STRUCTURE OF ^{15}C. Goss, J.D.; Jolivette, P.L.; Browne, C.P.; Darden, S.E. (Department of Physics, University of Nortre Dame, Notre Dame, Indiana 46556); Weller, H.R.; Blue, R.A. Phys. Rev. C 12: No. 6, 1730-1738 (Dec 1975).

A 14 MeV deuteron beam was used to measure the angular distributions for the ^{14}C(d, p)^{15}C reaction leading to the two bound states and eight of the unbound states of ^{15}C. Vector-analyzing powers were measured for the elastic scattering and for the two bound states. Distorted wave Born approximation calculations were performed and spectroscopic factors were obtained for the two bound states. Calculations for stripping to unbound states using a resonance form factor and following the approach of Vincent and Fortune were compared with the angular-distribution data of the unbound states to obtain values of J, π, and neutron width Γ_n. A strong J dependence occurs in the calculated cross sections for stripping to unbound states. (auth)

18885 EXCITATION OF DEEP LYING HOLE STATES IN ^{11}C, ^{15}O, ^{27}Si, AND ^{57}Ni WITH THE (^{3}He, α) REACTION AT 216 MeV. Gerlic, E.; Langevin-Joliot, H.; Roos, P.; Van de Wiele, J.; Didelez, J.P.; Duhamel, G. (Institut de Physique Nucléaire, 91406 Orsay, France). Phys. Rev. C 12: No. 6, 2106-2110 (Dec 1975).

The α spectra were investigated in the discrete and continuum regions. In addition to the well known low lying levels, peaks and broad structures are observed for each nucleus at higher excitation energies. The bumps location and spreading, their forward peaked distributions, suggest that they arise from neutron pickup in the deeper shells, i.e.,1s for ^{12}C and ^{16}O, 1$p_{3/2}$ for ^{28}Si and 1d + (1p) for ^{58}Ni. (auth)

18886 UNIFIED WEAK-COUPLING MODEL OF MASS 13 NUCLEI, INCLUDING EXCHANGE EFFECTS. Meder, M.R.; Purcell, J.E. (Department of Physics, Georgia State University, Atlanta, Georgia 30303). Phys. Rev. C 12: No. 6, 2056-2066 (Dec 1975).

Structure calculations on ^{13}C and ^{13}N are reported which use the weak-coupling model as a starting point. The same model is used for both positive- and negative-parity states. Exchange effects, which are especially important in the negative-parity states, are included by perturbation theory. ^{12}C core states used are 0$^+$, 2$^+$, 0^{+*}, 3$^-$, 4$^+$, and single-particle shell model states up through the s-d shell (plus the 1$f_{7/2}$, in one case) are included. Energy levels, moments, and transition rates are calculated and compared, where possible, with experiment. Generally, the results are excellent, except for $E1$ rates. Effective charges are used in the electromagnetic rate results. (auth)

18887 $N = Z$ EVEN-EVEN NUCLEI IN THE 2s-1d SHELL. Mpanias, P.; Rustgi, M.L. (Nuclear Physics Laboratory, Department of Physics, State University of New York at Buffalo, Buffalo, New York 14214). Phys. Rev. C 12: No. 6, 2072-2076 (Dec 1975).

The ground-state properties of $N = Z$ even-even 2s-1d shell nuclei are studied within the framework of the Hartree-Fock approximation employing the modified Yale potential and the supersoft core potential. Shell-model spaces of various sizes are used. The results are compared with similar but less sophisticated calculations published earlier. (auth)

18888 SECOND CLASS INTERACTIONS AND THE ELECTRON-NEUTRINO CORRELATION IN NUCLEAR BETA DECAY. Calaprice, F.P. (Department of Physics, Joseph Henry Laboratories, Princeton University, Princeton, New Jersey 08540). Phys. Rev. C 12: No. 6, 2016-2021 (Dec 1975).

The electron-neutrino correlation for ^{6}He β decay is analyzed for possible second class effects. Existing data are found to be consistent with there being no second form factor but the conclusion is somewhat model dependent. The $e\nu$ correlation for the ^{19}Ne decay is considered and it is shown that an improved measurement, comparable to that achieved for ^{6}He, would provide an unambiguous result concerning second class terms. (auth)

18889 EXPERIMENTAL STUDIES OF THE RESONANCE AT $E_{c.m.}$ = 19.7 MeV IN THE ^{12}C + ^{16}O SYSTEM. Shapira, D.; Stokstad, R.G.; Sachs, M.W.; Gobbi, A.; Bromley, D.A. (Wright Nuclear Sturcture Laboratory, Yale University, New Haven, Connecticut). Phys. Rev. C 12: No. 6, 1907-1917 (Dec 1975).

A resonance appearing in the ^{12}C + ^{16}O system at a center-of-mass incident energy of 19.7 MeV has been studied experimentally. Excitation functions for the ^{12}C + ^{16}O inelastic scattering and the ^{12}C(^{16}O, α)^{24}Mg* and ^{12}C(^{16}O, p)^{27}Al* reaction channels were measured. The width of the resonance was shown to be more than double the average level width in ^{28}Si at excitation energies around 36.5 MeV

where this resonance appears. The resonance is enhanced at large angles in the elastic and inelastic channels and it is found to be equally strong at $\theta_{c.m.} = 3°$ and 177° for the $^{12}C(^{16}O, p)^{27}Al$ reaction. The yield of 6.13 MeV γ radiation has been measured and is observed to resonate at $E_{c.m.} = 19.7$ MeV. High resolution measurements of the particle yield at $E_{c.m.} = 19.7$ MeV, $\theta_{lab} = 7.5°$ for the reaction $^{12}C(^{16}O, ^{12}C)^{16}O^*$ (6.05, 6.13 MeV) show that the 3⁻ (6.13 MeV) state is populated much more strongly than the 0⁺ (6.05 MeV) state. These results do not support the suggestion that the resonance has a ^{12}C-α-^{12}C molecular structure. Measurements of inelastic scattering at higher energies suggest the existence of additional correlated structures. A statistical analysis of the α-particle yields indicates that both compound and direct mechanisms contribute to the reaction. A discussion of the properties of the resonance in terms of intermediate structure and the statistical theory of Moldauer is given. (auth)

18890 ANALYSIS OF THE $^{12}C(^6Li,\alpha)^{14}N$ REACTION FOR $E(^6Li) = 33$ MeV. White, R.L.; Charlton, L.A.; Kemper, K.W. (Physics Department, Florida State University, Tallahassee, Florida 32306). Phys. Rev. C 12: No. 6, 1918-1926 (Dec 1975).

The $^{12}C(^6Li,\alpha)^{14}N$ reaction to the first eight $T = 0$ states was studied at $E(^6Li) = 33$ MeV in the angular range $12.5° \leq \theta \leq 165°$. The measurements for the positive parity states in ^{14}N also included the angular range from 2.5°–12.5°. Calculations for the angular distributions were done within the framework of the distorted-wave Born approximation (DWBA) with three different prescriptions: (1) zero-range two-particle transfer, (2) finite-range deuteron-cluster transfer, and (3) finite-range two-particle transfer, which included a full microscopic description of the two nucleon wave function. None of the three types of DWBA calculations could reproduce the data. Consequently, the possiblity of multistep contributions was investigated by computing the spectroscopic amplitudes for transitions from the 2⁺ first excited state in ^{12}C to the first two states in ^{14}N. It was found that the transfer strengths from the ^{12}C (4.43 MeV) to the ^{14}N (0.00 MeV) and ^{14}N (3.95 MeV) $J^\pi = 1^+$ levels are larger than those from the ^{12}C ground state. These results coupled with previous results showing that the $^{12}C(^6Li,\alpha)^{14}N$ reaction is not compound at this energy imply that multistep mechanisms may be very important. (auth)

18891 $^{10}B(^{14}N, \alpha)^{20}Ne$ REACTION IN THE REGION OF THE COULOMB BARRIER. L'Ecuyer, J.; Volders, R.; Cardinal, C.; Deschênes, L.; Marquardt, N. (Nuclear Physics Laboratory, Université de Montréal, Montréal, Québec, Canada). Phys. Rev. C 12: No. 6, 1878-1887 (Dec 1975).

The differential cross sections for the reaction $^{10}B(^{14}N, \alpha)^{20}Ne$ leading to the lower excited states of ^{20}Ne were measured at ^{14}N energies of 25 and 35 MeV. The excitation functions of those states were also measured at 0, 30, and 110° over the range $5.2 \leq E_{c.m.} < 13$ MeV. The data were analyzed in terms of the statistical compound nucleus model. The average behavior of this reaction is fairly reproduced by these calculations with reasonable values of the level density and spin cutoff parameters for this excitation energy region. Some features, however, could not be explained by this model. In particular, a large structure was seen in the 0° excitation function at 10 MeV(c.m.) in many channels, which is clearly not of statistical origin. A possible explanation is the presence of a doorway state in ^{24}Mg at the corresponding excitation energy. (auth)

18892 ENERGY LEVELS OF ^{12}B. Ajzenberg-Selove, F.; Middleton, R. (Department of Physics, University of Pennsylvania, Philadelphia, Pennsylvania 19174); Garrett, J.D. Phys. Rev. C 12: No. 6, 1868-1872 (Dec 1975).

The $^9Be(^7Li,\alpha)^{12}B$ reaction has been studied at $E(^7Li) = 20$ MeV using a multiangle spectrograph. Thirty-seven states of ^{12}B with $E_x < 14$ MeV have been observed. Angular distributions are presented for the first seven states of ^{12}B. The neutron reduced widths extracted from experimental total widths of the positive parity states are compared with shell-model predictions. (auth)

18893 STUDY OF THE REACTION $^{12}C + ^{13}C$ yields alpha + ^{21}Ne. Hallock, J. N.; Enge, H. A. (Massachusetts Inst. of Tech., Cambridge (USA). Dept. of Physics); Garrett, J. D.; Middleton, R.; Fortune, H. T. (Pennsylvania Univ., Philadelphia (USA). Dept. of Physics). Nucl. Phys., 252A: No. 1, 141-151(3 Nov 1975).

The reaction $^{12}C + ^{13}C$ yields alpha + ^{21}Ne has been investigated at c.m. bombarding energy of 14.5 MeV by using beams of both ^{12}C and ^{13}C. The alpha-particle reaction products were recorded by using a multiple-angle spectrograph. Seventy-six levels were observed below 12.56 MeV in ^{21}Ne; 28 levels from 9.42 to 12.56 MeV are reported for the first time. The data are consistent with a compound-nucleus reaction mechanism. (NL)

18894 THEORETICAL ANALYSIS OF THE PION CARBON SCATTERING AROUND THE 3-3 RESONANCE BY THE MULTIPLE SCATTERING THEORY. Nakano, K. Victoria, British Columbia; Univ. of Victoria (1975). vp. National Library of Canada, Ottawa.

Thesis (Ph. D.).

A theoretical analysis of the pion carbon scattering around the 3-3 resonance is carried out. The particular attention is put on the pion nuclear off-shell model dependence of the pion carbon scattering cross sections. For this purpose, an integral equation method in the multiple scattering formalism is developed. To obtain higher accuracy in the results, all calculations are carried out in momentum space, and careful attention is paid to the transformation from the pion nucleus center of mass system to the pion nucleon center of mass system. In order to investigate the dependence of the calculated pion nucleus scattering cross sections on the pion nucleon scattering model, elastic and inelastic pion carbon scattering cross sections are calculated from three different pion nucleon scattering models. One of them is the Chew model based on the field theoretical pion nucleon interaction, and the other two are phenomenological models, widely known as the Kisslinger and Landau-Tabakin models. The off-shell pion nucleon interaction is found to have a sizable effect on the pion nucleus cross sections. Observations concerning the sensitivity of the pion carbon scattering cross sections to the pion nucleon off-shell interaction are presented, and it is emphasized that the off-shell ambiguity must be settled along with other many-body effects, in order to make the pion nucleus scattering a reliable means of studying the nuclear structure. (Diss. Abstr. Int., B)

18895 RADIATIVE CAPTURE STUDIES OF ^{18}F AND ^{25}Al. Trautvetter, H. P. P. Toronto; Univ. of Toronto (1973). vp. National Library of Canada, Ottawa.

Thesis (Ph. D.).

The studies of the nuclear structure of the states of ^{18}F, using the radiative resonant capture reactions $^{14}N(\alpha,\gamma)^{18}F$ and $^{17}O(p,\gamma)^{18}F$ are described. The γ-decays of the excited ^{18}F nuclei were observed with large-volume high-resolution Ge(Li) detectors to obtain information on excitation energies, γ-ray branching ratios, electric and magnetic multipole mixing ratios, lifetimes and resonance strengths. From these quantities spin and parity assignments to the levels studied were deduced together with information on the particle widths. The present results together with those reported previously, indicate a spin sequence of $J^\pi = 1^+$, 2^+, 3^+, 4^+, and 5^+ for the states in ^{18}F at $E_x = 1701$, 2523, 3358, 5298, and 6568 keV respectively. The energy dependence for this sequence of states and the strength of the electric quadrupole transitions lead to the interpretation of this sequence as a rotational band. An important feature of each of the $J^\pi = 4^+$ and 5^+ unbound states was the unusual large reduced α-particle width. Results are compared with the strong and weak coupling approach to shell model calculations. The direct capture reaction $^{24}Mg(p,\gamma)^{25}Al$ was studied in order to deduce reduced particle widths of some of the bound states in ^{25}Al. The reduced widths found from experiment are compared with available results from stripping data and with Nilsson model predictions. In order to determine the direct capture cross sections quantitatively, a comparison to the resonant cross section can be made. However an inconsistency was found in the resonance strengths of the reaction $^{24}Mg(p,\gamma)^{25}Al$ reported in literature. Thus an independent measurement on the strength of the $E_R = 823$ keV resonance was carried out. This was done by comparing the resonant cross section to Rutherford cross section. (Diss. Abstr. Int., B)

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Refer also to abstracts 17223, 18779, 18787, 18801, 18827, 18830, 18834, 18835, 18837–18839, 18862, 18871, 18885, 18887, 18893, 18895, 18944, 18946, 18962, 19178, and 19185.

18896 (BNL-NCS-50446, pp 14-33) EVALUATION OF SODIUM-23 NEUTRON CAPTURE CROSS SECTION DATA FOR THE ENDF/B V-III FILE. Paik, N. C.; Pitterle, T. A. (Westinghouse Electric Corp., Madison, PA). Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

The evaluation of neutron cross sections of ^{23}Na, material number 1156, for the ENDF/B File is described. Cross sections were evaluated between 10^{-5} eV and 15 MeV. Experimental data available up to March 1971 were included in the evaluation. (auth)

18897 (BNL-NCS-50446, pp 34-41) EVALUATION OF THE $^{32}S(n,p)^{32}P$ REACTION FOR ENDF/B-III. Dudley, N. D.; Kennerley, R. (Argonne National Lab., IL). Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N. Y. (USA)).

The literature examined in this review includes all references in CINDA 71 and its supplements. Four experiments which have reported $^{32}S(n,p)$ cross sections near the reaction threshold of 1.6 MeV are compared. All used the activation technique and measured relative to a flux monitor. (auth)

18898 (IPNO-TH-75-24) SHAPE TRANSITION IN THE NEUTRON RICH SODIUM ISOTOPES. Campi, X.; Flocard, H.; Kerman, A. K.; Koonin, S. (Paris-11 Univ., 91 – Orsay (France). Div. de Physique Theorique). Jun 1975. 25p. INIS.

Mass spectrometer measurements of the neutron rich sodium isotopes show a sudden increase at ^{31}Na in the values of the two neutron separation energies. The spherical shell model naturally predicts a sudden decrease at ^{32}Na after the N = 20 shell closure. It is proposed that the explanation for this disagreement lies in the fact that sodium isotopes in this mass region are strongly deformed due to the filling of negative parity orbitals from the 1f$_{\frac{7}{2}}$ shell. Hartree-Fock calculations are presented in support of this conjecture. (FR)

18899 (ISN-TS-75-2) STUDY OF THE ^{22}Na(p,t)^{21}Na REACTION. Agard, M. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 (France)). 1975. 62p. (In French). INIS.

The reaction ^{23}Na(p,t)^{21}Na has been studied at E(p) = 40 MeV and angular distributions in the region 12.5 deg < theta(cm) < 82.5 deg have been obtained. Using shell model calculations employing an effective interaction in a space restricted to the 1d5/2 and 2s1/2 shells it was shown that the DWBA theory reproduced several of the observed angular distributions. The level situated at 5386 keV was identified as having J(π) = $^1/_2^+$. (FR)

18900 (LYCEN-7504) ELASTIC AND INELASTIC PROTON SCATTERING FROM ^{21}Ne AND T = 1 ENERGY LEVELS IN ^{22}Na. Chambon, B.; Desgrolard, P.; Drain, D.; Lumbert, M.; Persehaye, N. (Lyon-1 Univ., 69 – Villeurbanne (France). Inst. de Physique Nucleaire). Jan 1975. 32p. INIS.

Excitation functions for the reactions ^{21}Ne(p,p) and ^{21}Ne(p,p') were studied at 8 angles for bombarding energies in the range E(p) = 0.6 – 2.0 MeV. A total of 21 resonances was observed corresponding to ^{22}Na levels between 7.3 and 8.6 MeV excitation energy. The proton angular momenta are determined; spin and parity assignments are presented. Several new isobaric analog pairs in ^{22}Na and ^{22}Ne are also presented. Previous experimental and nuclear structure information is discussed. (FR)

18901 (ORO-4856-26, pp 69-70) STRUCTURE OF INTRINSIC STATES OF K/sup pi/ equals 0$^+$ BANDS IN ^{20}Ne. Nemoto, F. (Kyoto Univ.); Yamamoto, Y.; Horiuchi, H.; Suzuki, Y.; Ikeda, K. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18902 (ORO-4856-26, pp 236-237) TWO-CLUSTER STRUCTURE OF SOME ALPHA-SCATTERING RESONANCES IN THE sd SHELL. Budzanowski, A.; Grotowski, K.; Strzalkowski, A. (Jagellonian Univ., Krakow). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The excitation functions of the elastic scattering of alpha particles at backward angles on ^{24}Mg and ^{28}Si nuclei in the energy range from 23 to 28 MeV measured by Bobrowska et al. exhibit distinct maxima. It was shown that these maxima are not correlated with the structures seen in the excitation functions of the (alpha,alpha') and (alpha,p) reactions leading to low-lying excited states of the final nucleus possibly indicating the presence of Ericson fluctuations. (auth)

18903 (ORO-4856-26, pp 238-239) ANOMALOUS LARGE-ANGLE alpha-SCATTERING FROM ^{20}Ne. Cowley, A. A.; Heymann, G.; Van Staden, J. C.; Burdzik, G. F.; Mills, S. J. (CSIR, Pretoria). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Backward-angle alpha-particle elastic scattering from ^{20}Ne is analyzed with a Regge pole model and compared with previous results for ^{16}O. (auth)

18904 (ORO-4856-26, pp 313-314) QUASI-FREE (p,p alpha) SCATTERING AT 156 MeV ON ^{24}Mg, ^{28}Si, ^{40}Ca AND ^{58}Ni. Bachelier, D.; Boyard, J. L.; Hennino, T.; Holmgren, H. D.; Jourdain, J. C.; Radvanyi, P.; Roos, P. G.; Roy-Stephan, M. (IPN, Orsay, France). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Differential cross-sections have been measured from 0 to 200 MeV/c recoil momentum and from 0 to 20 MeV excitation energy of the residual nuclei. The extraction of spectroscopic factors is under way. (auth)

18905 (ORO-4856-26, pp 315-316) QUASIFREE SCATTERING IN THE ^{24}Mg(p,p alpha)^{20}Ne REACTION AT 100 MeV. Steinberg, R. I.; Chang, C. C.; Chant, N. S.; Didelez, J. P.; Holmgren, H. D.; Roos, P. G.; Wu, J. S. (Univ. of Maryland, College Park). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Quasifree scattering data are presented on the ^{24}Mg(p,p alpha) ^{20}Ne reaction for two pairs of quasifree angles for an incident proton energy of 100 MeV. (auth)

18906 (ORO-4856-26, pp 325-326) EVIDENCE FOR SURFACE alpha-PARTICLE CLUSTERS IN Ag AND Au FROM THE (e,alpha) REACTION. Dodge, W. R.; Molen, H. V. (National Bureau of Standards, Washington, DC). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The (e,p) and (e,alpha) energy and angular distributions in Ag and Au were measured at several electron bombarding energies between 50 and 115 MeV. Taking the ratio of asymmetric to symmetric angular distribution yields as an estimate of the fractions of alpha-yields which cannot be accounted for by statistical theories in a straight-forward manner, it is concluded that at electron bombarding energy of 110 MeV, 13 percent of our Ag and 14 percent of our Au alpha's cannot be accounted for by statistical processes. (auth)

18907 (ORO-4856-26, pp 354-355) GAMMA-RAY PRODUCTION CROSS-SECTIONS FROM THE INTERACTION OF 140 MeV ALPHA-PARTICLES WITH ^{27}Al(I). Hornyak, W. F.; Chang, C. C.; Walters, W. B. (Univ. of Maryland, College Park). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18908 (ORO-4856-26, pp 356-357) GAMMA-RAY PRODUCTION CROSS-SECTIONS FROM THE INTERACTION OF 140 MeV ALPHA-PARTICLES WITH ^{27}Al (II). Hornyak, W. F.; Wall, N. S. (Univ. of Maryland, College Park). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The pure evaporation model program was run for the ^{27}Al(alpha, 2 alpha) and ^{27}Al(alpha, 3 alpha) reactions to determine the yield. Limitations of the program are discussed. (BJG)

18909 (ORO-4856-26, pp 411-412) ALPHA-PARTICLE PICK-UP REACTIONS IN THE 2sld SHELL. Cossairt, J. D. (Indiana Univ., Bloomington); Bent, R. D.; Broad, A. S.; Becchetti, F. D.; Janecke, J. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The ^{24,26}Mg(d,^{6}Li)^{20,22}Ne, ^{28}Si(d,^{6}Li)^{24}Mg and ^{32}S(d,^{6}Li)^{28}Si reactions have been studied at E/sub d/ equals 35 MeV. The results are in qualitative agreement with predictions of SU$_3$ theory. (auth)

18910 (ORO-4856-26, pp 456-457) SYSTEMATICS OF ALPHA-PARTICLE STRENGTHS OF LOW-LYING LEVELS IN LIGHT sd-SHELL NUCLEI. Anantaraman, N.; Draayer, J. P.; Gove, H. E. (Univ. of Rochester, NY). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

A survey of alpha-particle spectroscopic factors of low-lying levels in sd-shell nuclei with A less than or equal to 29 as measured by the (^{6}Li,d) reaction at energies up to 36 MeV is presented. A comparison is made with theoretical predictions not only for inter- and intra-band transitions in a given nucleus, but also with the absolute ground state to ground state transitions. Substantial agreement is obtained, but some unexplained discrepancies remain. (auth)

18911 (ORO-4856-26, pp 528-529) EVIDENCE FOR A ^{12}C + ^{12}C COLLECTIVE BAND IN ^{24}Mg. Cosman, E. R. (Massachusetts Inst. of Tech., Cambridge); Cormier, T. M.; Van Bibber, K.; Sperduto, A.; Young, G.; Erskine, J.; Greenwood, L.; Hansen, O. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
Excitation functions of the $^{12}C(^{12}C,p)^{23}Na$ and $^{12}C(^{12}C,d)^{22}Na$ reactions are studied with high resolution from E/sub cm/(^{12}C) equals 6.75 to 30 MeV using the BNL and ANL tandem Van de Graaff accelerators. The presence of a pronounced and correlated set of resonances near E/sub x/(^{24}Mg) equals 25.2, 28.2, and 33.3 MeV appearing in the E/sub x/ equals 9.04 and 9.81 MeV states of ^{23}Na is revealed. (auth)

18912 (ORO-4856-26, pp 534-535) HIGH SPIN STATES IN ^{23}Na AND THE E/sub c.m./ equals 19.3 MeV $^{12}C + ^{12}C$ RESONANCE. Betts, R. R.; Back, B. B.; Gaarde, C.; Hansen, O.; Oeschler, H. (Niels Bohr Inst., Copenhagen). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18913 (ORO-4856-26, pp 536-537) NEUTRON SPECTRA FROM THE $^{12}C(^{13}C,n)^{24}Mg$ REACTION. Kollarits, R. V.; Geller, K. N. (Drexel Univ., Philadelphia). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
In order to obtain additional information on the $^{12}C + ^{13}C$ system, the $^{12}C(^{13}C,n)^{24}Mg$ reaction is investigated which is more likely to evidence intermediate structure since the neutron is weakly bound to the ^{12}C core. Results on the neutron spectra from this reaction are presented. Back angle data are obtained by reversing the role of target and projectile. (auth)

18914 (ORO-4856-26, pp 538-539) INTERMEDIATE STRUCTURE IN THE $^{12}C(^{13}C,n)^{24}Mg$ REACTION. Geller, K, N.; Kollarits, R. V. (Drexel Univ., Philadelphia). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18915 $^{23}Na(d,\alpha)^{21}Ne$ REACTION FOR DEUTERON ENERGIES OF 2.3 TO 4.0 MeV. Vysotskii, G. Ya.; Zalyubovskii, I. I.; Zabegai, V. M.; Kuznichenko, A. V.; Lobkovskii, A. P.; Melenevskii, A. E.; Nemets, O. F.; Nemykin, V. N. (Kharkov State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1566-1571 (Aug 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1761-1765(Aug 1970).
The excitation functions and angular distributions for ^{23}Na $(d,\alpha)^{21}Ne$, which go via the compound nucleus ^{25}Mg at excitation energies of 18.91 to 20.48 MeV, are examined. (JFP)

18916 INELASTIC SCATTERING OF γ RAYS BY ^{27}Al AND ^{28}Si. Ishkhanov, B. S.; Kapitonov, I. M.; Lazutin, E. V.; Piskarev, I. M.; Sopov, V. S.; Shevchenko, V. G. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1601-1603(Aug 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1802-1804(Aug 1970).
The γ-ray spectra from $^{27}Al(\gamma,p\gamma')$, $^{27}Al(\gamma,n\gamma')$, $^{28}Si(\gamma,p\gamma')$, and $^{28}Si(\gamma,n\gamma')$ at 35 MeV were examined in order to investigate the decay of highly excited states of nuclei. Transitions for these nuclei are listed, integral and resonance cross sections are discussed, and a lower bound to the formation of reaction products in excited states is derived. (JFP)

18917 ENERGY DEPENDENCE OF PROTON POLARIZATION IN SCATTERING BY ^{24}Mg NEAR THE 5.72 AND 5.91 MeV RESONANCES. Gustova, L. V.; Vaganov, P. A.; Chubinskii, O. V.; Kuz'mitskii, I. V.; Vinogradov, L. I.; Serebrow, A. P. (Leningrad State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1930-1933(Oct 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2163-2167(Oct 1970).
The purpose was to study experimentally the influence of resonance effects on scattering of protons by ^{24}Mg at energies near 6 MeV. Measurements were made of the angular dependence of the proton polarization in elastic and inelastic scattering by ^{24}Mg for three proton energies, 6.00, 5.90, and 5.80 MeV, which are close to the proton resonance energies 5.72 and 5.91 MeV. These resonances correspond to levels of the compound nucleus ^{25}Al at 7.78 MeV (width 340 keV) and 7.97 MeV (width 40 keV). Also the differential cross sections are discussed. (JFP)

18918 THERMODYNAMIC DESCRIPTION OF THE ENERGY SPECTRA OF NUCLEI. Sokolov, Yu. V.; Stavinskii, V. S.; Usachev, L. N. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1603-1605(Aug 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1805-1807(Aug 1970).
It was previously shown, in particular, that the degeneracies and the truncation of the spectrum have their greatest effects on $\bar{U}$ (mean energy), S (entropy) and $a^* = S^2/4\bar{U}$ (level density parameter). One considers in more detail both of these effects for real spectra using ones published for ^{24}Mg, ^{31}P, ^{52}Cr, and ^{90}Zr. These spectra were chosen because they are the most complete (the last measured ϵ_k is fairly high) and the angular momentum, used to determine degeneracy, has been measured for most of the levels. (JFP)

18919 ELASTIC SCATTERING OF POLARIZED PROTONS BY ^{28}Si. Andreev, G. B.; Slabospitskii, R. P.; Borovlev, V. I.; Lapatko, I. D.; Lutsik, V. A. (Physical-Technical Inst., Kharkov). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1571-1575(Aug 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1766-1770(Aug 1970).
It was of interest to make more careful polarization measurements on a beam of initially polarized protons in elastic scattering by ^{28}Si in the range 1.5 to 3.0 MeV. In view of the extension of polarization measurements, it was desirable to examine the elastic scattering of protons with silicon as the polarization analyzer because it is easy to make a silicon target as a free film. Also total widths and lifetimes of some excited states of phosphorus-29 were found. (JFP)

18920 STATISTICAL ANALYSIS OF THE (p,α) REACTION ON CHLORINE ISOTOPES. Antropov, A. E.; Gusev, V. P.; Zarubin, P. P.; Orlov, B. N.; Sorokin, A. I. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1517-1519(Aug 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1707-1709(Aug 1970).
Recently the angular distributions of the α_0 and α_1 groups from the $^{37}Cl(p,\alpha)^{34}S$ and $^{35}Cl(p,\alpha)^{32}S$ reactions were measured for incident proton energies of 5.84, 5.93, and 6.03 MeV. The form of these angular distributions suggests the possibility of describing them on the basis of the Hauser-Feshbach theory. Such a description is attempted. The averaged angular distributions are presented. They are nearly symmetric about 90°, except for the forward angles, where there are evidently contributions from direct interactions. The angular distribution for the $^{37}Cl(p,\alpha_1)^{34}S$ reaction is similar to that given previously. The calculations were carried out for three values of σ^2, and the values of Γ/D_0 so obtained are given. The values σ_1^2 correspond to the assumption that the nucleus has the solid-body moment of inertia for $r_0 = 1.2$ fermi. The values σ_2^2 were taken from previous work. The best agreement is achieved for the values σ_1^2 corresponding to a nuclear moment of inertia between 20 amd 30% of the solid-body value.

18921 STATISTICAL ANALYSIS OF THE (p,α) REACTION ON SULFUR ISOTOPES. Antropov, A. E.; Zarubin, P. P.; Orlov, B. N.; Rybnikov, A. F.; Sorokin, A. I. (Leningrad State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1519-1522(Aug 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1710-1713(Aug 1970).
The results of some measurements and a statistical analysis of the (p,α) reaction on two sulfur isotopes ^{33}S and ^{34}S are presented in order to supplement data presented earlier. The angular distributions of the α particles of the α_0 and $\alpha_1 + \alpha_2$ groups from the $^{33}S(p,\alpha)^{30}P$ reaction for $E_p = 6.08$ MeV and similar results for the $^{34}S(p,\alpha)^{31}P$ reaction for three proton energies close to 6 MeV are shown. For the $^{34}S(p,\alpha)^{31}P$ reaction the α-particle yields in the α_0 and α_1 groups were measured at angles of 120 and 160° as functions of the incident-proton energy. The calculations were based on a new program giving the absolute cross section in terms of the parameters of the compound nucleus (Γ and D_0) on the basis of the Hauser-Feshbach-Moldauer theory. (JFP)

18922 BETA RECOIL EFFECTS IN THE DELAYED ALPHA DECAY OF ^{20}Na. Macfarlane, R. D.; Oakey, N. S. (Niels Bohr Inst., Copenhagen). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1880-1883(Oct 1970).
From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2109-2112(Oct 1970).
A recent study of the alpha spectrum of ^{23}Na under conditions of high energy resolution is reported from which one can obtain directly from the alpha spectrum a partial level scheme. In addition it is possible to obtain beta decay Q values and some qualita-

tive information on beta$^+$- nu correlations from the measured shapes of the individual alpha lines. The line broadening is also discussed. (JFP)

18923 DWBA ANALYSIS OF THE ANGULAR DISTRIBUTION AND POLARIZATION OF NEUTRONS FROM THE REACTION $^{12}C(d,n_0)^{13}N$ IN THE DEUTERON ENERGY RANGE 1.7 TO 2.8 MeV. Bondouk, I. I. (Atomic Energy Establishment, Cairo). Ann. Phys. (Leipzig); 32: No. 4, 261-264(Jun 1975).

The angular distribution and the polarization of neutrons from the reaction $^{12}C(d,n_0)^{13}N$ in the deuteron energy range 1.7 to 2.8 MeV were analyzed in terms of the DWBA theory. (auth)

18924 LOW-LYING STATES IN ^{20}Ne POPULATED BY THE $^{19}F(^7Li, ^6He)^{20}Ne$ REACTION AT 34 MeV. Williams-Norton, M.E.; Hudson, G.M.; Kemper, K.W.; Moore, G.E.; Norton, G.A.; Puigh, R.J.; Zeller, A.F. (Department of Physics, The Florida State University, Tallahassee, Florida 32306). Phys. Rev. C 12: No. 6, 1899-1906 (Dec 1975).

Angular distributions have been measured for transitions to ^{20}Ne states up to 7.43 MeV in excitation populated in the $^{19}F(^7Li, ^6He)^{20}Ne$ reaction at $E_{^7Li}$ = 34 MeV. Elastic scattering of ^{6}Li and ^{7}Li at 34 MeV from ^{19}F was also performed and optical model parameters were determined from fits to the measured angular distributions. These optical model parameters were used in finite-range distorted-wave Born-approximation analyses of the single nucleon transfer data to extract spectrosopic factors for states at 0.0, 1.634, 4.247, 5.785, 6.722, and 7.424 MeV excitation in ^{20}Ne. Spectroscopic factors obtained from this reaction agree well with those from light-ion transfer reactions. However, the $2s_{1/2}$ calculation for the ^{20}Ne ground state is out of phase with the data by 7°. The "j-forbidden" 4$^+$ state at 4.247 MeV excitation is found to be weakly excited in the $^{19}F(^7Li, ^6He)^{20}Ne$ reaction. (auth)

18925 HYPERFINE INTERACTIONS OF LIGHT NUCLEI RECOIL-IMPLANTED INTO IRON. Bożek, E.; Hrynkiewicz, A.Z.; Merdinger, J.C.; Vivien, J.P. (Centre de Recherches Nucléaires, 67037 Strasbourg-Cédex, France). Phys. Rev. C 12: No. 6, 1873-1877 (Dec 1975).

The perturbed integral angular distribution technique has been used to study hyperfine interactions of light nuclei recoil-implanted into iron. Heavy-ion-induced fusion-evaporation reactions populated the excited states of ^{37}Ar, ^{39,40,41}K, and ^{41}Ca, whose deexciting γ rays were observed in a Ge(Li) detector. In all cases the measured shifts of the angular distributions were found much smaller than the ones calculated using the known values of g factors, lifetimes, and strengths of the internal hyperfine fields. This can be explained under the assumption that only a fraction of the nuclei feel the full internal magnetic field, while the rest of them do not feel any magnetic interaction at all. Different fractions obtained for ^{40}K and ^{41}K suggest a migration process on a ns time scale of the implanted ions in the lattice. (auth)

18926 STUDY OF THE $^{21}Ne(t, p)^{23}Ne$ REACTION. Desgrolard, P.; Chambon, B.; Drain, D.; Pastor, C. (Institut de Physique Nucléaire, Université Claude Bernard Lyon-I and IN2P3, 43, Bd du 11 novembre 1918, 69621 Villeurbanne, France); Dauchy, A. Phys. Rev. C 12: No. 6, 1711-1716 (Dec 1975).

Investigation of the $^{21}Ne(t, p)^{23}Ne$ reaction with 3 and 3.25 MeV projectiles reveals eight new (energy) levels between E_x = 5.3 and 6.5 MeV. Absolute differential cross sections for 18 proton groups are reported. Distorted-wave Born approximation analysis and Hauser-Feshbach calculations indicate that $L = 0$ is involved in the formation of one of the members of the doublets at E_x = 3.432-3.458 and 4.995-5.036 MeV as well as in the formation of a new level at 5.74 ± 0.04 MeV. A mixture of $L = 0$ and $L = 2$ transfer is associated with the formation of the 1.822 MeV level. For these four levels $J^\pi = 3/2^+$ is deduced. (auth)

18927 NEUTRON RESONANCES IN ^{24}Na VIA THE (d, p) REACTION. Blanpied, G.; Liljestrand, R.; Lynch, J.; McIntyre, J.; Ray, L.; Hoffmann, G.W. (Department of Physics, University of Texas, Austin, Texas 78712). Phys. Rev. C 12: No. 6, 1726-1729 (Dec 1975).

Neutron resonances in ^{24}Na from $E_x = 0$ to 1 MeV are studied with the $^{23}Na(d, p)^{24}Na$ reaction at E_d = 11.0 MeV using a biased quadrupole spectrometer. Fractionated single-particle states are identified via their forward angle cross sections, using distorted wave Born-approximation predictions with resonance state form factors for the residual ^{24}Na system. Spectroscopic results are compared with those from (n, n) and/or (n, γ) studies over the same region of excitation. (auth)

18928 NEUTRON CAPTURE CROSS SECTION OF NATURAL SILICON. Boldeman, J. W.; Allen, B. J.; Musgrove, A. R. deL. (Australian Atomic Energy Commission Research Establishment Lucas Heights). Nucl. Phys., A; 252: No. 1, 62-76(3 Nov 1975).

The neutron capture cross section of natural silicon has been measured to 1500 keV by using the capture cross section facility of the 40-m station of the Oak Ridge Electron Linear Accelerator. Analysis of the present data, in combination with existing total cross section information, has provided almost complete resonance data for ^{28}Si. On the other hand, the capture kernel only (g GAMMA/sub n/GAMMA/sub gamma/GAMMA) has been obtained for neutron capture resonances in ^{29}Si and ^{30}Si. A strong positive correlation has been observed between the radiative width and the corresponding reduced neutron width for p-wave resonances in ^{28}Si, confirming significant valence effects. It is noted that a quantitative valence calculation provides only an approximate estimate of the valence strength for this nucleus. It was not possible to confirm, from the present measurements, reported asymmetry observed in two resonances in the ^{29}Si(gamma,n) reaction. (NL)

18929 CALCULATION OF THE STATIC AND DYNAMIC TRIAXIAL SHAPES OF ^{24}Mg. Grammaticos, B. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Service de Physique Theorique). Nucl. Phys., A; 252: No. 1, 90-102 (3 Nov 1975).

The Skyrme interaction is used in a Hartree–Fock calculation of ^{24}Mg with triaxial symmetry. A transition between axial and triaxial shapes is studied as a function of the spin–orbit strength. The effect of the other components of the interaction on the shape of ^{24}Mg is examined. Constrained Hartree–Fock calculations of the energy surface and the cranking mass parameter are used for the calculation of the intrinsic gamma vibration. The main result of the dynamical calculation is that despite the different equilibrium shapes obtained with the two forces SIII and SV, the triaxiality obtained by considering the zero-point gamma oscillation is essentially the same for both forces. (NL)

18930 STRUCTURE OF THE EXCITED BAND IN ^{24}Mg. Pauling, L. (Linus Pauling Institute of Sciences and Medicine, Menlo Park, California 94025). Phys. Rev. Lett. 35: No. 21, 1480-1482 (24 Nov 1975).

I propose for the 18–39-MeV excited collective band in ^{24}Mg an intrinsic cluster structure with tetragonal symmetry, point group 4 2m, obtained by approximating edges of two ^{12}C triangles to form a central bisphenoid. With the helion-helion distances in the ^{12}C clusters assumed to retain their ^{12}C value, 3.81 fm, the four lateral edges of the bisphenoid are found from the observed values of the levels to have length 4.15 fm. The agreement of this value with values for other nuclei supports the proposed structure. (auth)

18931 DWBA ANALYSIS FOR SINGLE-PARTICLE TRANSFERS INDUCED BY ^{11}B ON ^{26}Mg at 114 MeV. Paschopoulos, I.; Fisher, P. S.; Jelley, N. A.; Kahana, S.; Pilt, A.A.; Rae, W.D.M.; Sinclair, D. (Oxford Univ. (UK). Nuclear Physics Lab.). Nucl. Phys., A; 252: No. 1, 173-186(3 Nov 1975).

Detailed angular distributions were measured for all four possible single-nucleon-transfer reactions induced by a 114-MeV ^{11}B beam on ^{26}Mg by using a position-sensitive counter telescope. Diffractive oscillations observed in the transfer data are reproduced by the distorted-wave Born-approximation analysis. A well-determined class of optical potentials, which are strongly absorbing in the nuclear interior but nearly transparent at the surface, were obtained by fitting the entrance channel elastic scattering data. Spectroscopic factors for final target states were deduced, in good agreement with those obtained from light-ion experiments. (NL)

18932 ASSIGNMENT OF ERRORS TO CALCULATED TRANSITION MATRIX ELEMENTS. Timmer, G. A.; Meurders, F. (Rijksuniversiteit Utrecht (Netherlands). Fysisch Lab.). Phys. Lett., B; 58: No. 4, 411-413(29 Sep 1975).

Errors are assigned to calculated transition matrix elements to account for uncertainties in the model Hamiltonian. The method is illustrated for the lowest five levels of ^{26}Al, for which an excellent correlation is found between the size of the assigned errors and the deviations between theory and experiment. (NL)

18933 (alpha, d) REACTION ON ^{27}Al AND ^{26}Mg. Spross, R. L. College Station, TX; Texas A and M Univ. (1975). 232p. University Microfilms Order No. 75-25,145.

Thesis (Ph. D.).

Spectra of dueterons from the ^{26}Mg(alpha, d)^{28}Al and ^{27}Al(alpha, d)^{28}Si have been obtained using a charge-division position-sensitive proportional counter. Spectra for ^{26}Mg(alpha, d)^{28}Al were taken in 5.0° steps in the laboratory from 5.0° to 50.0°, and in 2.5° steps in the laboratory from 5.0° to 55.0° for ^{27}Al(alpha, d)^{28}Si. Angular distributions for many levels in ^{28}Al were analyzed using the distorted wave Born approximation (DWBA). The 9.78 MeV (7$^+$) level is strongly excited and a strong state at 8.25 MeV is a possible 6$^-$ state, being primarily the target coupled to a (d/sub 5/2/t/sub 1/2/)$_{6^-}$ configuration. Angular distributions for low-lying, positive-parity levels in ^{28}Si were analyzed. Spin assignments are made for levels at 6.42 MeV (5/2$^+$), 6.91 MeV (5/2 – 1/2)$^+$, 7.07 (3/2 – 1/2)$^+$, 8.16 MeV (3/2 – 1/2)$^+$, 8.34 MeV (1/2$^+$), 8.76 MeV (3/2 – 1/2)$^+$,

9.20 MeV($\frac{1}{2}$ - $\frac{5}{2}$)$^-$, and 9.76 MeV($\frac{3}{2}$ - $\frac{7}{2}$)$^+$. In addition, the $\frac{7}{2}^-$ level at 3.62 MeV is strongly excited. A multiplet of levels formed by coupling a (f/sub $\frac{7}{2}$)$_7$,^{2} configuration to the $\frac{5}{2}^+$ target is seen. Possible strong members are at 12.68 MeV, 13.64 MeV, and 15.52 MeV, and two weaker members are seen at 14.69 MeV and 14.78 MeV. Based on the 2J +1 rule and shell model considerations, the strong members are probably the high spin members of the multiplet ($11\frac{1}{2}^+$, $15\frac{1}{2}^+$, $17\frac{1}{2}^+$, and $19\frac{1}{2}^+$). Theoretical considerations imply that the $\frac{9}{2}^+$ level is high in excitation, and is probably either the 14.69 or 14.78 MeV level. (Diss. Abstr. Int., B)

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Refer also to abstracts 17223, 18782, 18787, 18801, 18827, 18830, 18834, 18835, 18837–18839, 18870, 18885, 18887, 18904, 18918, 18919, 18973, 18975, 19017, 19036, 19058, 19146, 19212, and 19224.

18934 (BNL-NCS-50446) ENDF/B-IV DOSIMETRY FILE. Magurno, B. A. (ed.). (Brookhaven National Lab., Upton, N. Y. (USA)). Apr 1975. Contract E(30-1)-16. 285p. (ENDF-216; NEACRP-L-145; NEANDC(US)-193/L; INDC(US)-70/L). Dep. NTIS $8.75.

Separate abstracts have been prepared for 22 papers which appear in both Nuclear Science Abstracts and ERDA Research Abstracts. (SDF)

For abstracts of individual papers see: 18769, 18799, 18896, 18897, 18935–18942, 18977–18980, 19012–19014, 19094, 19108, and 19109.

18935 (BNL-NCS-50446, pp 42-50) EVALUATION OF THE ^{45}Sc(n,gamma)^{46}Sc REACTION FOR ENDF/B-IV. Magurno, B. A.; Mughabghab, S. F. Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

Because of the importance of ^{45}Sc in dosimetry applications and its use as a filter to produce a "monoenergetic" neutron beam at 2.0 keV an accurate knowledge of the cross sections is required. A previous analysis and evaluation of the total cross section in the thermal and resonance region is extended here to include the capture cross section from the thermal region to 20 MeV. (auth)

18936 (BNL-NCS-50446, pp 51-69) EVALUATION OF THE (n,p) AND (n,np) REACTIONS OF THE ISOTOPES OF TITANIUM FOR ENDF/B-IV. Magurno, B. A. Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

Threshold detectors generally use elemental titanium rather than isotopically enriched samples necessitating the evaluation of all the (n,p), (n,np), and (n,d) reactions of the major contributing isotopes separately. ^{49}Ti and ^{50}Ti are not dealt with here since they are both approximately 5 percent abundant and have small cross sections. The (n,np), (n,pn) and (n,d) reactions are lumped together and called (n,np). The energy range is divided into three regions. Region I is that of threshold to 7 MeV, Region II, 7 to 12 MeV and Region III, 12 to 20 MeV. (auth)

18937 (BNL-NCS-50446, pp 70-73) EVALUATION OF THE ^{55}Mn(n,2n)^{54}Mn CROSS SECTION FOR ENDF/B-IV. Magurno, B. A.; Takahashi, H. Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

The ^{55}Mn(n,2n)^{54}Mn cross section was one of the reactions to be supplied by the Cross Section Evaluating Working Group (CSEWG) for the Interlaboratory LMFBR Reaction Rate Program (ILRR). This reaction was later incorporated into a complete isotopic evaluation for ENDF/B-IV by H. Takahashi. This description of the evaluation was extracted from the final report. (auth)

18938 (BNL-NCS-50446, pp 74-79) EVALUATION OF THE ^{54}Fe(n,p)^{54}Mn REACTION FOR ENDF/B-III DOSIMETRY FILE. Schenter, R. E. (Hanford Engineering Development Lab., Richland, WA). Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

The literature reviewed in this evaluation includes all references in CINDA 72 and its supplements plus papers describing recent measurements by Smith and Meadows and Paulsen and Widera. (auth)

18939 (BNL-NCS-50446, pp 80-87) EVALUATION OF THE ^{56}Fe(n,p)^{56}Mn CROSS SECTIONS FOR ENDF/B-III. Dudey, N. D.; Kennerley, R. (Argonne National Lab., IL). Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

The literature examined in this review includes all references in CINDA 71 and its supplements plus some very recent measurements near the reaction threshold. All reference cross sections have been renormalized to ENDF/B-III cross sections and weighted least-squared fitting routines were used to systematize the evaluations. (auth)

18940 (BNL-NCS-50446, pp 88-91) EVALUATION OF THE ^{58}Fe(n,gamma)^{59}Fe REACTION FOR ENDF/B-IV DOSIMETRY FILE. Schenter, R. E. (Hanford Engineering Development Lab., Richland, WA). Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

The literature reviewed in this evaluation includes all references in CINDA 72 and its supplements plus the theoretical calculations of Green et al. (auth)

18941 (BNL-NCS-50446, pp 108-113) ^{58}Ni(n,2n)^{57}Ni REACTION FOR ENDF/B-IV. Bhat, M. R. Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

An evaluation is made of the ^{58}Ni(n,2n)^{57}Ni cross section between threshold (12.415 MeV) and 20 MeV. (SDF)

18942 (BNL-NCS-50446, pp 114-119) EVALUATION OF THE ^{59}Ni(n,p)^{59}Co REACTION FOR ENDF/-III DOSIMETRY FILE. Schenter, R. E. (Hanford Engineering Development Lab., Richland, WA). Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

The literature reviewed in this evaluation includes all references in CINDA 72 and its supplements plus papers describing recent measurements by Smith and Meadows and Paulsen and Widera. (auth)

18943 (CEA-CR-2, pp 56-76) ANALYSIS OF ELECTRON ELASTIC SCATTERING AT HIGH MOMENTUM. Bellicard, J. B. [nd]. (In French).

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8-10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91 – Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

Limits in the analysis of electron elastic scattering experiments using phenomenological models are recalled. Two new analysis methods (Sick and Negele models) where model dependence is reduced are developed. Preliminary results on an electron scattering experiment on ^{58}Ni at high momentum, recently performed at Saclay, are presented. (FR)

18944 (COO-2186-29) NUCLEAR SPECTROSCOPY AND NUCLEAR REACTION WORK WITH (A) THE SUPER HILAC AT BERKELEY; THE HEAVY ION ACCELERATOR AT YALE AND (B) THE 4 MeV DYNAMITRON SUNY, ALBANY, NEW YORK. Technical Progress Report, December 1, 1974–July 31, 1975. Bakhru, H. (State Univ. of New York, Albany (USA)). 1975. Contract AT(11-1)-2186. 25p. Dep. NTIS $4.50.

Several projects initiated in the past year at the Heavy Ion Accelerator Laboratory have been brought to satisfactory conclusions and a number of new projects have been started. These new projects are logical extensions of our inquiries into nuclear structure through radioactive decay and in-beam spectroscopy. The collaboration efforts at Super-HILAC at Berkeley with Professor J. O. Rasmussen and Professor N. Cue at SUNY/Albany have proved to be very effective and productive. The argon and krypton data from the Super-HILAC at Berkeley were analyzed to study x-rays in heavy ion collisions. Studies on millisecond isomer in ^{199}Tl were completed. The measurements of the K-shell and L-shell ionization with fully stripped projectiles using various heavy ions have been carried out. The 4 MeV Dynamitron Accelerator at SUNY/Albany has been extensively used to conduct the high resolution studies of MeV heavy ion induced x-rays. Alpha capture studies on ^{35}Cl, ^{37}Cl and ^{31}P have been undertaken at SUNY/Albany. (auth)

18945 (ORO-4856-26, pp 160-161) POSSIBLE CONNECTION BETWEEN "ALAS" AND ANOMALOUS (^{3}He, alpha) SPECTROSCOPIC FACTORS. Apell, H. J. (Univ., Marburg, Ger.); Gemeinhardt, W.; Stock, R.; Betts, R. R.; Hansen, O.; Sperduto, A.; Fuchs, H.; Santo, R. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18946 (ORO-4856-26, pp 240-241) EXPERIMENTAL STUDY OF NUCLEAR STRUCTURE EFFECTS IN BACKWARD-ANGLE

ALPHA SCATTERING. Schiffer, J. P.; Eberhard, K. A.; Schiele, J.; Wit, M. (Univ., Munich). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The increase around A equals 40 at backward angles in elastic alpha scattering is largely destroyed by a pair of nucleons in the f/sub 7/2/ shell (^{40}Ar, ^{41}K, ^{42}Ca) but apparently not by one f/sub 7/2/ particle (^{41}K) or one or a pair of d/sub 3/2/ holes (^{39}K, ^{38}Ar). No similar effects appear in heavier nuclei. Recent studies of the energy dependence of this backward increase suggest that it is not due to an enhancement of compound elastic scattering, but to a direct (non-fluctuating) component. (auth)

18947 (ORO-4856-26, pp 360-361) CHARGED PARTICLE SPECTRA FROM 100 MeV PROTON ON ^{58}Ni. Wu, J. R.; Chang, C. C.; Holmgren, H. D.; Wall, N. S.; Didelez, J. P.; Butterfield, C. (Univ. of Maryland, College Park). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

18948 FUNCTIONS FOR ANALYSIS OF ALLOWED M AND N CAPTURE. Suslov, Yu. P. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1983-1987(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk. SSSR, Ser. Fiz.; 34: No. 10, 2223-2227(Oct 1970).

Relativistic calculations of functions are carried out for analysis of electron capture from the M shell and, partially, from the N shells under the same assumptions as previously used to obtain similar functions for analysis of K and L capture. For the atomic potential a self-consistent potential was used with inclusion of exchange by Slater's method; the finite nuclear size was taken into account by using the uniformly charged sphere model with radius $R = 1.2 \cdot A^{1/3}$ fermi. The general expressions for the probability of electron capture have been extended to M capture by Robinson and Hubbard. These expressions contain quantities L_ν, N_ν, and M_ν which are expressed in terms of the electron radial wave functions at the nuclear surface. One obtains the corresponding functions L_ν, N_ν, and M_ν for analysis of allowed and forbidden capture from the M_I and M_{II} subshells for Z = 14 to 39 and all the M shells and the N_I and N_{II} subshells for Z = 40 to 98. The calculations were made by means of the same program used previously with use of a self-consistent potential (for Z ≥72 one used a similar relativistic potential). Only allowed capture from the M_I, M_{II}, N_I, and N_{II} subshells is discussed. (JFP)

18949 ELASTIC AND INELASTIC SCATTERING OF PROTONS ON IRON ISOTOPES. Andronov, Yu. F.; Antropov, A. E.; Zarubin, P. P.; Ioannu, P. D.; Nikitaeva, V. I.; Orlov, B. N.; Romanov, V. S. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1934-1938(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2168-2173(Oct 1970).

The study of the elastic and inelastic scattering of ~6-MeV protons on ^{56}Fe, ^{57}Fe, and ^{58}Fe is reported. On the basis of the results an attempt was made to assess the contributions from direct and indirect processes to the scattering of protons on iron isotopes and to learn something about the low-lying excited states of ^{57}Fe. The angular distributions of the elastically and inelastically scattered protons, measured in most cases in the range 30 to 160° are shown. Three features appear when the angular distributions of the scattered protons are compared. The differential cross sections are also discussed. (JFP)

18950 POSSIBILITY OF USING DEUTERON-DISINTEGRATION REACTIONS TO INVESTIGATE NUCLEAR SURFACES. Nemets, O. F.; Pugach, V. M.; Sokolov, M. V.; Struzhko, B. G. (Inst. of Physics, Kiev). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1523-1527(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk. SSSR, Ser. Fiz.; 34: No. 8, 1714-1718(Aug 1970).

Results are presented on the breakup of 13.6-MeV deuterons on targets of nickel and copper isotopes and also on targets of natural isotopic composition. The proton spectra, angular correlations, and cross sections are discussed. Some properties of the nuclear surface are deduced. (JFP)

18951 L-SHELL INTERNAL CONVERSION COEFFICIENTS FOR HIGH-ENERGY TRANSITIONS. Trusov, V. F. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1476-1480(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1661-1665(Aug 1970).

L-shell ICC are presented for atoms with Z = 50, 60, . . . , 100 for γ transitions with energies up to 10 mc^2 (for conversion on the L_I subshell) or 7 mc^2 (for the L_{II} and L_{III} subshells). The calculations were made as in previous work. To allow for screening a universal potential with linear deformation of the effective charge was used. Only part of the results are presented. Complete tables of ICC have been compiled for all Z from 16 to 100 for conversion of 1 to 9 MeV transitions on the K shell, and for Z from 50 to 100 for L-shell conversion (for electric and magnetic transitions of the first four multipole orders). Analysis of the calculated ICC showed that the deviations from the inverse proportionality law are due to the effects of screening. (JFP)

18952 STUDY OF EXCITED STATES IN ^{41}Sc VIA ELASTIC SCATTERING OF POLARIZED PROTONS BY ^{40}Ca. Lopatko, I. D.; Borovlev, V. I.; Andreev, G. B.; Lutsik, V. A.; Slabospitskii, R. P. (Physical-Technical Inst., Kharkov). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1943-1947(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2179-2182(Oct 1970).

To study the polarization of protons elastically scattered by ^{40}Ca nuclei in the proton energy range 2.30 to 2.80 MeV, a primary polarized proton beam was used. Various properties of scandium-41 levels are discussed. (JFP)

18953 FORMATION OF ^{4}He IN THE DECAY OF COMPOUND NUCLEI WITH HIGH ANGULAR MOMENTA. Avdeichikov, V. V.; Lozhkin, O. V.; Perfilov, N. A. (Radium Inst., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1484-1492(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1670-1679(Aug 1970).

The formation of α particles in nuclear reactions produced by high energy heavy ions (~10 MeV/nucleon) was examined restricting attention to interactions in which the decisive part is played by complete fusion of the ion with the nucleus and statistical decomposition of the resulting system. The distinctive features of the compound system in this case are that the excitation energy U is high (> 100 MeV) and the angular momentum I is very high (up to about 100h), so one can examine the behavior at high U and I. The experiments concern the differential spectra and angular distributions of the ^{4}He nuclei produced by decay of various compound nuclei formed in heavy ion reactions. Especial attention is given to the purity of the statistical reaction mechanism, the form of $d^2\sigma/dEd\Omega$ near the barrier, and the possible effects of polarization of the compound nuclei. Neon-22 ion reactions with Ni, Nb, Ag, and Au nuclei at 175.4 MeV are considered. (JFP)

18954 GAMMA-DECAY OF THE FRAGMENTED ANALOG OF THE ^{59}Fe GROUND STATE. Brondi, A.; Moro, R.; Pelfer, P.; Terrasi, F. (Univ., Naples). Nuovo Cim.; 30A: No. 3, 483-497 (1 Dec 1975).

The excitation function of the ^{58}Fe(p,γ)^{59}Co reaction was measured in the analog region E_p = (2150 to 2270) keV. γ-ray spectra were measured at four resonances; excitation energies and branchings of the resonance levels and several bound states were extracted. A decay scheme involving 36 excited states was proposed for ^{59}Co. A Q value of (7363 ± 1.4) keV was obtained. Total and partial radiation widths and inelastic widths were measured for eight components of the fragmented analog of the ^{59}Fe ground state. The strength of the analog to antianalog transition was found to be 0.07 W.u. Correlations between different channels were investigated. (auth)

18955 ELASTIC MAGNETIC ELECTRON SCATTERING BY ^{39}K NUCLEUS. Likhachev, V. P.; Afanasiev, N. G.; Nemashkalo, A. A.; Savitskii, L. A.; Khvastunov, V. M.; Yaroshevskii, L. D. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 9, 1484-1489(Sep 1975). (In Russian)

Differential cross sections of the electron elastic scattering by ^{39}K nucleus were measured at the constant $q' = 2.05$ f^{-1} momentum transfer. Electric and magnetic contributions to the total form factor of the elastic scattering were separated. The M3 values of the ^{39}K nucleus momentum were determined. (auth)

18956 TOTAL (p,n) CROSS SECTIONS TO GROUND STATE ANALOG STATES OF ^{48}Ca, ^{50}Ti, ^{52}Cr, AND ^{58}Ni. Folkmann, F.; Gaarde, C. (Niels Bohr Institutet, Copenhagen (Denmark)). Nucl. Phys., A; 252: No. 2, 343-353(10 Nov 1975).

Total (p,n) cross sections to isobaric analogs of 0^+ ground states are determined from the yield of γ-rays, de-exciting the IAS. Excitation functions are measured for targets ^{48}Ca, ^{50}Ti, ^{52}Cr and ^{58}Ni from threshold to 6.4, 4.0, 3.3 and 2.2 MeV above. The measured

cross sections are compared with calculated cross sections for compound-nucleus and direct reaction mechanisms. The decay scheme of the analog state at 6.68 MeV in ^{48}Sc is established. Measured inelastic and elastic scattering of protons on ^{48}Ca at 8 to 10.2 MeV show correlations with the neutron channel leading to the analog state. (NL)

18957 LARGE ANGLE SCATTERING OF 100 MeV α-PARTICLES FROM ^{40,44,48}Ca. Eickhoff, H.; Frekers, D.; Leohner, H.; Poppensieker, K.; Santo, R. (Muenchen Univ. (F. R. Germany). Inst. fuer Kernphysik); Gaul, G. (Muenchen Univ. (F.R. Germany). Sektion Physik); Mayer-Boericke, C.; Turek, P. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik). Nucl. Phys., A; 252: No. 2, 333-342(10 Nov 1975).

The elastic and inelastic scattering of α-particles from ^{40,44,48}Ca has been studied at E_α = 100 MeV between θ_{lab} = 16 and 166°. The elastic angular distributions show an overall similarity; some differences, however, in the large angle cross sections for the different isotopes are still present. The data have been analyzed in terms of the optical model and the folding model. The data are discussed in connection with those at lower energies, where the back-angle anomalies were observed. (NL)

18958 THICKNESS DEPENDENCE OF MOESSBAUER ABSORPTION LINE AREAS IN POLARIZED AND UNPOLARIZED ABSORBERS. Williams, J. M.; Brooks, J. S. (Sheffield Univ. (UK). Dept. of Physics). Nucl. Instrum. Methods; 128: No. 2, 363-372(1 Oct 1975).

Moessbauer absorption theory is presented with particular attention to the dependence of line areas on thickness. The saturation of the line area ratios of two lines within a hyperfine-split ^{57}Fe spectrum is studied, and from thickness dependence measurements in both unpolarized and polarized spectra a new method of estimating recoil-free fractions is presented. (NL)

18959 SEARCH FOR ISOBARIC ANALOGUE STATES IN ^{58}Co FROM THE ^{57}Fe(p,γ)^{58}Co REACTION. Erlandsson, B.; Marcinkowski, A. (Lund Univ. (Sweden)). Phys. Scr.; 12: No. 1-2, 95-102(Aug 1975).

The ^{57}Fe(p,γ)^{58}Co reaction has been investigated in the proton energy region E_P = 1580–2125 keV. Branching ratios for low-lying levels and decay schemes for seven resonances have been investigated, and possible analog states or fragments of analog states of the 2782-keV (1^+) and 2876-keV (2^+) levels in ^{58}Fe have been suggested. The investigated analog states give a Coulomb displacement energy of 8846 ± 20 keV. (NL)

18960 DESCRIPTION OF ELASTIC $\alpha-^{40}$Ca SCATTERING BY THE RESONATING GROUP METHOD. Friedrich, H.; Langanke, K. (Muenster Univ. (F.R. Germany). Inst. fuer Theoretische Physik). Nucl. Phys., A; 252: No. 1, 47-61(3 Nov 1975).

Elastic α scattering on ^{40}Ca is studied microscopically by the resonating-group method. The RGM potentials are determined by directly unfolding the associated integral kernels of the generator-coordinate method. The results confirm the concept of quasi-molecular rotational states, which has been used to account for the backward angle anomaly observed in elastic $\alpha-^{40}$Ca cross sections. (NL)

18961 VECTOR ANALYZING POWER AND CROSS SECTION FOR (d(pol),p) REACTIONS ON ^{53}Cr, ^{57}Fe, ^{117}Sn, AND ^{119}Sn. Kocher, D. C.; Haeberli, W. (Wisconsin Univ., Madison (USA)). Nucl. Phys., A; 252: No. 2, 381-415(10 Nov 1975).

Angular distributions of the vector analyzing power and the absolute cross section were measured for (d(pol),p) reactions on the odd-A nuclei ^{53}Cr and ^{57}Fe at a deuteron energy of 10 MeV and on ^{117}Sn and ^{119}Sn at 12 MeV. It is shown that the separate cross section contributions for the different allowed total angular momenta j/sub n/ of the captured neutron can be determined from the measurements. For transitions which are dominated by a single value of j/sub n/, the measurements are compared with distorted-wave Born-approximation calculations. The energies of the 2p/sub 3/2/ and 2p/sub 1/2/ neutron single-particle states in ^{54}Cr and ^{58}Fe were determined, and the strength of the nuclear spin–orbit interaction was calculated. The vector analyzing power and the cross section were also measured for deuteron elastic scattering from each target nucleus in order to determine optical-model parameters for the DWBA calculations. (NL)

18962 FOLDING-MODEL ANALYSIS OF ELASTIC ALPHA–NUCLEUS SCATTERING. Singh, P. P.; Schwandt, P.; Yang, G. C. (Indiana Univ., Bloomington (USA)). Phys. Lett., B; 59: No. 2, 113-117(27 Oct 1975).

A real potential obtained by folding the nucleon–nucleus phenomenological potential with the alpha-particle form factor is shown to describe elastic alpha-nucleus scattering data over a wide range of bombarding energy (20–160 MeV) and target mass (24–90 amu). The observed dependence of the alpha–nucleus potential strength on alpha energy is also well accounted for by the model. (NL)

18963 TWO-STEP CONTRIBUTIONS TO THE ^{40}Ar(p,n)^{40}K ANTI-ANALOG STATE TRANSITION. Rudolph, H.; Zafiratos, C. D.; Bentley, R. F.; Lind, D. A. (Colorado Univ., Boulder (USA). Dept of Physics and Astrophysics); Rickertsen, L. D. (Oak Ridge National Lab., Tenn. (USA)). Phys. Lett., B; 59: No. 2, 129-131(27 Oct 1975).

Calculations for the ^{40}Ar(p,n)^{40}K reaction to the 0^+ anti-analog state (AAS) are given along with experimental angular distributions for an incident proton energy of 22.8 MeV. The results of the calculations show little sensitivity to the parameters. The large-angle data and the relative strengths of the analog state and AAS cross sections indicate that the two-step (p,d)(d,n) process plays a dominant role in the AAS transition. (NL)

18964 ENERGY DEPENDENCE OF THE SURFACE ABSORPTION AND Ni + ^{16}O SCATTERING. Satchler, G. R. (Oak Ridge National Lab., Tenn. (USA)). Phys. Lett., B; 58: No. 4, 408-410 (29 Sep 1975).

Data for Ni + ^{16}O elastic scattering are analyzed to determine the real and imaginary potentials near the strong absorption radius as a function of bombarding energy. A strong energy dependence is found for the ratio of the imaginary part to the real part at this radius. (NL)

18965 LEVEL STRUCTURE OF ^{54}Mn FROM THE ^{56}Fe(p,^{3}He) REACTION AT 40.2 MeV. Guichard, A.; Benenson, W.; Nann, H. (Cyclotron Laboratory and Physics Department, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. C 12: No. 6, 1762-1770 (Dec 1975).

The ^{56}Fe(p,^{3}He)^{54}Mn reaction has been studied at an incident energy of 40.2 MeV. Levels up to 6.16 MeV of excitation have been observed with an energy resolution of 25 keV. The experimental angular distributions have been analyzed with the distorted-wave Born approximation. Several L assignments have been made which, when compared to other experimental data, permitted new spin assignments. A comparison with theoretical calculations is also presented. (auth)

18966 ^{52}Cr(p, ^{3}He)^{50}V REACTION. Guichard, A.; Benenson, W.; Markham, R.G.; Nann, H. (Cyclotron Laboratory and Physics Department, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. C 12: No. 6, 1780-1788 (Dec 1975).

The energy levels in ^{50}V have been observed up to 3.9 MeV with the ^{52}Cr(p, ^{3}He) reaction at 40.2 MeV incident energy. Forty-five levels have been seen, and a distorted wave analysis permitted L assignments for most of them. These results are compared to existing information and to $f_{7/2}{}^n$ shell-model calculations. (auth)

18967 TOTAL (p, n) REACTION CROSS-SECTION MEASUREMENTS ON ^{50}Ti, ^{54}Cr, AND ^{59}Co. Kailas, S.; Gupta, S.K.; Mehta, M.K.; Kerekatte, S.S.; Namjoshi, L.V. (Nuclear Physics Division, Bhabha Atomic Research Centre, Bombay-400 085, India); Ganguly, N.K.; Chintalapudi, S. Phys. Rev. C 12: No. 6, 1789-1796 (Dec 1975).

The total (p, n) reaction cross sections, integrated over the 4π solid angle and summed over all neutron groups, for ^{50}Ti, ^{54}Cr, and ^{59}Co have been measured as a function of proton energy in the energy range 3.0–4.9, 2.2–5.2, and 2.0–5.1 MeV in 5 keV steps, respectively. No strong isobaric analog resonances were seen in the data. The fluctuations in the excitation functions were analyzed to extract $\langle \Gamma \rangle_w$ values using the "counting of maxima" method. The excitation functions, averaged over 100 keV energy interval reveal prominent intermediate width structures in the case of ^{50}Ti. All the three excitation functions were averaged over suitable energy intervals and compared with the total reaction cross sections calculated utilizing the optical model. The data on ^{59}Co and ^{54}Cr agreed, while the data on ^{50}Ti indicated a marked discrepancy with these optical model calculations. In the latter case, detailed Hauser-Feshbach (HF) and Hauser-Feshbach-Moldauer (HFM) calculations were carried out. The HFM calculations fit the data quite well. The importance of $\sigma(p, n)$ measurements in determining the imaginary potential of the optical model at sub-Coulomb energies has been indicated. (auth)

18968 SPECTROSCOPIC FACTORS FROM THE ^{48}Ti(d,p)^{49}Ti REACTION. Terenetskii, K. D.; Tokarevskii, V. V. (Kiev State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1552-1554(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1745-1747(Aug 1970).

The nucleon optical potential was used to determine the parameters for the DWBA analysis of the experimental angular distributions of protons from the ^{48}Ti(d,p)^{49}Ti reaction at an incident-deuteron energy of 13.6 MeV. In the calculations the deuteron optical-model parameters were used that were obtained previously. The spectroscopic factors and the first excited ($2P_{\frac{1}{2}}$) state of titanium-49 are discussed. (JFP)

18969 MAGNETIC MOMENT OF THE $d_{3/2}$ HOLE STATE IN ^{49}Ti. Haas, B.; Chevallier, A.; Chevallier, J.; Gehringer, C.; Merdinger,

J.C.; Schulz, N.; Styczen, J.; Taras, P.; Toulemonde, M.; Vivien, J.P. (Centre de Recherches Nucléaires et Université Louis Pasteur, Strasbourg, France). Phys. Rev. C 12: No. 6, 1865-1867 (Dec 1975).

The nuclear g factor of the 330 keV $3/2^+$ state in ^{45}Ti has been measured as $g = 0.65 \pm 0.16$ using the ^{42}Ca(α, n)^{45}Ti reaction and the time-integral perturbed angular distribution method. The deduced magnetic moment value $\mu = (0.98 \pm 0.24)\mu_N$ is consistent with a $d_{3/2}$ neutron hole state interpretation of this level. (auth)

18970 LIFETIMES OF SOME LOW-LYING LEVELS OF ^{55}Co. Caldwell, S.E.; Alexander, L.A.; Arns, R.G.; Brunner, B.J.; Kovash, M.A.; Rozsa, C.M.; Smith, J.W. (The Ohio State University, Columbus, Ohio 43210). Phys. Rev. C 12: No. 6, 2084-2087 (Dec 1975).

Excitation energies and nuclear lifetimes of levels in ^{55}Co have been measured via the reaction ^{54}Fe(^{3}He, $d\gamma$)^{55}Co induced by 11.0 MeV incident ^{3}He^{++} particles. The Doppler shifted γ-ray spectra, taken in coincidence with the outgoing deuterons, were fitted by a line shape analysis program to determine the lifetimes. Experimental results for excitation energies ($\pm$ 1 keV) and and lifetimes (ps) are: 2166, $0.141^{+0.020}_{-0.021}$; 2566, $0.620^{+0.120}_{-0.090}$; 2940, ≥ 0.590; 3324, $0.090^{+0.017}_{-0.012}$; 4166, $0.050^{+0.010}_{-0.005}$. (auth)

18971 FURTHER EVIDENCE FOR THE RECENTLY DISCOVERED DOUBLET IN ^{48}Ca. Tape, J.W. (Department of Physics, Rutgers University, New Brunswick, New Jersey 08903 and Bell Laboratories, Murray Hill, New Jersey 07974); Ulrickson, M.; Benczer-Koller, N.; MacDonald, J.R. Phys. Rev. C 12: No. 6, 2125-2126 (Dec 1975).

The existence of a doublet near 4.51 MeV in ^{48}Ca is confirmed and the results of previous measurements are reexamined. (auth)

18972 ^{51}V(d, n_0)^{52}Cr REACTION WITH POLARIZED DEUTERONS. Quin, P.A.; Thomson, J.A. (University of Wisconsin, Madison, Wisconsin 53706). Phys. Rev. C 12: No. 6, 2118-2120 (Dec 1975).

The vector analyzing power of the ^{51}V(d, n_0)^{52}Cr reaction has been measured for laboratory angles between 5° and 40° at a deuteron energy of 11 MeV. Distorted-wave calculations are in qualitative agreement with the observed angular dependence of the vector analyzing power. (auth)

18973 DECAY OF ^{49}Cr. Jackson, S.V.; Henry, E.A.; Meyer, R.A. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Rev. C 12: No. 6, 2094-2096 (Dec 1975).

For the decay of ^{49}Cr the intensities of the 1361-, 1423-, 1508-, 1514-, and 1570-keV γ rays are found to be 0.85, 0.19, 0.15, 0.49, and 0.37, respectively, relative to $I_\gamma = 1000$ for the 90-keV γ ray. Four other previously reported γ rays are shown to be sum peaks or contaminants. The recalculated β-decay branches and logft values (in parentheses) for ^{49}Cr decay are ground state (5.51), 90.639- (4.94), 152.928- (4.74), 1514.5- (5.71), 1661.1- (6.06), 2181.7- (7.0), 2236- (6.6), and 2310-keV (7.1). The known $3/2^+$ level at 748 keV was not observed to be populated and a limit of log$ft > 9$ was found for that level. (auth)

18974 EFFECTIVE CROSS SECTIONS FOR THE (n, $2pn$), (n, 2), AND (n, $3pn$) REACTIONS USING INTERMEDIATE-ENERGY NEUTRONS. Hill, J.C.; Shirk, D.G. (Ames Laboratory-ERDA and Department of Physics, Iowa State University, Ames, Iowa 50010); Petry, R.F.; Wang, K.H. Phys. Rev. C 12: No. 6, 1978-1982 (Dec 1975).

"Effective cross sections" for the (n, $2pn$), (n, $2p$), and (n, $3pn$) reactions on various targets were measured relative to the ^{12}C(n, $2n$)^{11}C reaction. The bombarding particles were the spectrum of neutrons generated in a Cu beamstop by 750-MeV protons. The cross section systematics as a function of target mass number are compared with available 14-MeV neutron cross sections for (n,^{3}He) and (n,$2p$) reactions and with results from intranuclear-cascade calculations. (auth)

18975 RADIATIVE CAPTURE REACTIONS ^{40}Ca(alpha, gamma)^{44}Ti AND ^{48}Ca(alpha, gamma)^{52}Ti IN THE REGION OF THE GIANT DIPOLE RESONANCE. Peschel, R. E. New Haven; Yale Univ. (1975). 93p. University Microfilms Order No. 75-24,586.

Thesis (Ph. D.).

An investigation of the reactions ^{40}Ca(alpha, gamma)^{44}Ti and ^{48}Ca(alpha, gamma)^{52}Ti in the region of the giant dipole resonance (GDR) has been completed. For the ^{40}Ca(alpha, gamma) reaction, 90 degree excitation functions over the bombarding energy range 6.5 to 17.5 MeV were obtained for gamma transitions to the ground state and first excited state in ^{44}Ti and for a sum of the unresolved transitions to the third and fourth excited states in ^{44}Ti. Angular distributions were measured at the extrema of the excitation functions. The data reveal that the ^{40}Ca(alpha, gamma) reaction proceeds predominantly via the isospin forbidden E1 transition and populates the T equals 1, GDR states of ^{44}Ti via T equals 0 isospin impurities. The results provide an estimate of the isospin mixing in the GDR as well as support for a possible giant quadrupole resonance (GQR) below the GDR in ^{44}Ti. The excitation functions exhibit a gross structure which reflects the isospin mixing in the GDR of ^{44}Ti, and a structure of intermediate width which may reflect T equals 0 alpha cluster states in ^{44}Ti. The ^{48}Ca(alpha, gamma) 90 degree differential cross section was investigated over the bombarding energy range 6.0 to 14.0 MeV. The isospin allowed ^{48}Ca(alpha, gamma$_0$) reaction was found to be a factor of 20 smaller in cross section than the isospin forbidden ^{40}Ca(alpha, gamma$_0$) reaction. (Diss. Abstr. Int., B)

18976 NUCLEAR OPTICAL MODEL FOR ^{3}He AND ^{4}He PROJECTILES. Chang, H. H. Boulder, CO; Univ. of Colorado (1975). 170p. University Microfilms Order No. 75-23,576.

Thesis (Ph. D.).

The well-known ambiguities in the real part of the nuclear optical model potentials used to represent the elastic scattering of ^{3}He and ^{4}He projectiles by medium weight nuclei are investigated. Recent analyses of elastic scattering data for ^{3}He and ^{4}He indicated that large angle data with sufficient high energy could resolve the discrete ambiguities in the real optical potential. Differential elastic scattering cross sections for ^{3}He and ^{4}He projectiles were measured at 83.5 MeV and 82.0 MeV respectively on targets of ^{40}Ca and ^{58}Ni. Conventional optical model fits to the ^{3}He elastic scattering data at 83.5 MeV exhibited a strong preference for the U approximately 120 MeV potential family. This potential family is shallower than that given by the single nucleon optical potential depth times the number of nucleons in the projectile. The inclusion of large angle ^{4}He elastic scattering data at 82 MeV on ^{40}Ca and ^{58}Ni did not resolve the ambiguity in the optical model potentials and showed only a slight preference for the U approximately 130 MeV potential family. The energy dependence in the optical potential was studied for ^{3}He from 21 to 83.5 MeV and for ^{4}He from 20 to 140 MeV. Energy dependent terms in the optical potential were found to be considerably different for the low and high energy data for both projectiles. The energy mass dependences were examined for three families of potentials for low energy ^{3}He scattering data. A crude theoretical model was used to estimate the mass dependence in the real strength parameter due to the finite size of the projectile. These analyses suggest that the U approximately 120 MeV potential family is slightly favored. This is consistent with the previous high energy analysis. (Diss. Abstr. Int., B)

Nuclear Properties and Reactions, 59 ≤ A ≤ 89

Refer also to abstracts 18801, 18830, 18835, 18837, 18934, 18948, 18950, 18951, 18953, 18954, 18967, 18974, 18994, and 19045.

18977 (BNL-NCS-50446, pp 92-107) EVALUATION OF ^{59}Co(n,gamma)^{60}Co, ^{59}Co(n,2n)^{58}Co, ^{59}Co(n alpha)^{56}Mn, FOR ENDF/B-IV. Krieger, T. J. (Argonne National Lab., IL); Smith, A. B.; Smith, D. L.; Jenkins, J. D. Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N.Y. (USA)).

The present evaluation of ^{59}Co (n,gamma) for ENDF/B IV consists of two parts, an evaluation below 100 keV by T. J. Krieger, Brookhaven National Laboratory, and one above 100 keV by A. B. Smith and D. L. Smith, Argonne National Laboratory. (auth)

18978 (BNL-NCS-50446, pp 120-125) ^{60}Ni(n,p)^{60}Co REACTION FOR ENDF/B-IV. Bhat, M. R. Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N. Y. (USA)).

The ^{60}Ni(n,p)^{60}Co cross section is evaluated in the energy range 5.76 to 19.55 MeV. (SDF)

18979 (BNL-NCS-50446, pp 126-142) ^{63}Cu(n,gamma); (n, alpha) REACTIONS FOR ENDF/B-IV. Alter, H. Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N. Y. (USA)).

Evaluated data sets for ^{63}Cu(n,gamma) and (n,alpha) reactions contained in the ENDF/B-III and SAND files were reviewed, compared and where possible, intercompared with measured data. (auth)

18980 (BNL-NCS-50446, pp 143-149) ^{65}Cu(n,2n)^{64}Cu REACTION FOR ENDF/B-IV. Rose, P. F. Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N. Y. (USA)).

The ^{65}Cu(n,2n)^{64}Cu reaction has been re-evaluated for the ENDF/B-files using a combination of selected experimental data and a semi-empirical technique for fitting the data at energies above 15 MeV. An estimate of the (n,3n) reaction was also obtained as a result of the analysis. (auth)

18981 (CSNSM-T-75-01) MEASUREMENT OF THE CROSS SECTION FOR THE FORMATION OF STABLE ISOTOPES OF Be, Sc, V, Cr, AND Mn BY SPALLATION OF Fe WITH HIGH ENERGY PROTONS. Perron, C. (Paris-11 Univ., 91-Orsay (France)). 1975. 123p. (In French). Dep. NTIS (US Sales Only) $6.50.

Thesis.

The stable isotopes of Be, Ca, Sc, Ti, V, Cr, and Mn produced by the spallation of Fe with high energy protons were studied. The thermographic method was adapted to the chemical separation of the spallation products. The analysis by mass spectrometry with ionic pulverization gas the formation cross sections for the stable (or long-lived) isotopes of Be, Sc, V, and Cr at 600 MeV and 21 GeV and/or Mn at 600 MeV. The formation cross sections of some radioactive isotopes at 21 GeV were remeasured by spectrometry. The results of these measurements were applied to the study of the propagation of cosmic radiation. The experimental values of the cross sections confirm that the abundances of the ensemble of secondary products of cosmic radiation are explained by admitting exponential distribution distances with a mean value of the order of 5 g/cm^2. However other distributions can explain the abundances of the secondary products of Fe alone. The abundances of the elements studied are compatible with a zero abundance at the source. There was no disagreement between the calculations and observations made at energies up to 100 GeV/n. Results on radioactive isotopes formed only by electron capture were presented. (JSR)

18982 (FRNC-TH-568) CONTRIBUTION TO THE STUDY OF HEAVY ION TRANSFER REACTIONS. Problems of Optical Potential and Core Excitation. Sztark, H. (Paris-7 Univ., 75 (France)). 1975. 131p. (In French). INIS.

The experimental study of the following transfer reactions is presented: ^{64}Ni(^{16}O,^{15}N)^{65}Cu at 56 MeV and ^{64}Ni(^{12}C,^{11}B)^{65}Cu at 48 MeV; ^{64}Ni(^{16}O,^{14}C)^{66}Zn at 56 MeV and ^{64}Ni(^{12}C,^{10}Be)^{66}Zn at 48 MeV; and (^{16}O,^{14}C) reactions on ^{76}Ge, ^{74}Ge and ^{72}Ge targets. It is shown that the shape of the angular distributions can be explained by studying reaction mechanisms. For the first reactions DWBA calculations are in agreement with the experimental results and show the importance of recoil effects in heavy ion induced reactions. Similar effects appear in the second-type reactions where the description of the two nucleons transferred play a major part in the intensity of the cross sections. As for Ge nuclei which have states with strong collective structure, the study of two proton transfer reactions such as (^{16}O, ^{14}C) reveals a two-step reaction mechanism. CCBA calculations were carried out and are shown to be in good agreement with the angular distributions. (FR)

18983 (FRNC-TH-574) STUDY OF THE DISINTEGRATION OF SHORT-LIFE FISSION PRODUCTS. Application to the Mass Distribution in the Fission of ^{238}U and ^{233}U Induced by 14 MeV Neutrons. Cavallini, P. (Grenoble-1 Univ., 38 (France)). 1975. 108p. (In French). INIS.

Nuclear spectrometry of short-life fission products was investigated, together with direct applications to the study of mass and charge distribution in fission reactions. It is shown that, by choosing judiciously the target in which the fission product is created and owing to the differences in stabilities and evaporation temperatures of the compounds obtained, it is possible to separate some elements. For example, niobium was separated by heating after irradiation of a mixture of UC and $RuCl_3$, and sublimation in a tube with temperature gradient. It was thus possible to study the ^{99}Nb isotope. Other classical chemical separation processes were used for yttrium and strontium. The half-lifes beta and gamma spectra, decay schemes of ^{93}Sr, ^{94}Y and ^{95}Y were studied. It was shown how to obtain mass distribution in fission using a nondestructive gamma analysis method. As an application, results obtained in the fission of ^{233}U and ^{238}U at 14 MeV are given. (FR)

18984 (ISN-T-75-02) STUDY OF THE NICKEL ISOTOPES WITH (p,d) AND (p,t) REACTIONS. Interpretation in the Framework of Nuclear Shell Model. Kong-A-Siou, D. H. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 (France)). 1975. 133p. (In French). INIS.

The ^{61}Ni, ^{62}Ni(p,d) and ^{60}Ni, ^{62}Ni, ^{64}Ni(p,t) reactions have been studied and spins, isospins and parities have been assigned to more than fifty levels. A very strong j-dependence effect of l = 3 transitions have been observed in the (p,d) reactions. The experimental data are compared to results of shell model calculations undertaken with four active orbits (2p3/2, 1f5/2, 2p1/2 and 1g9/2) outside the ^{56}Ni core. (FR)

18985 (LSN-N-75-01) ^{72}Ge, ^{70}Ge AND ^{76}Se EVEN-EVEN NUCLEI STRUCTURE WITH (^{3}He, d) AND (d, n) REACTIONS. Ardouin, D. (Nantes Univ., 44 (France). Lab. de Spectroscopie Nucleaire; Nantes Univ., 44 (France)). 1975. 117p. (In French). INIS.

The ^{69}Ga(^{3}He,d)^{70}Ge, ^{71}Ga(^{3}He,d)^{72}Ge and ^{75}As(^{3}He,d)^{76}Se reactions have been studied at 25MeV incident energy using a split pole spectrometer. The overall resolution is 18-21keV. About sixty or seventy levels are populated below 5.2MeV excitation energy in each of the ^{70}Ge, ^{72}Ge and ^{76}Ge isotopes. Many new levels are observed even at low excitation energy. Angular distributions are obtained and comparison with D.W.B.A. calculations allows spin parity assignments or limits; particularly new $J^\pi = 0^+$ and 4^+ levels are proposed. Spectroscopic factors are deduced for most of the observed transitions. A cursory investigation of the ^{69}Ga^{71}Ga(d,n)^{70}Ge^{72}Ge and ^{79}Br^{81}Br(^{3}He,d) ^{80}Kr^{82}Kr reactions has also been performed. Systematics are thus presented for the first excited levels between N = 38 and 46. Strong analogies also appear between ^{76}Ge, ^{72}Ge, ^{76}Se and ^{80}Kr, ^{82}Kr excited levels. A simple model is proposed which can account for the strong population of the first excited 0^+ state in ^{72}Ge. From present or previously known experimental systematics, conclusions are drawn concerning the possibility of an oblate to prolate shape transition between N = 36 and 46, the critical structure of the nuclei in the N = 40 region and the non-collective structure of the first excited 0^+ state. Potential-energy surfaces obtained by Hartree-Fock calculations, using the Skyrme interaction, confirm the above conclusions. (FR)

18986 (ORO-4856-26, pp 350-351) PREEQUILIBRIUM ALPHA EMISSION FROM PROTON, DEUTERON, ^{3}He AND ALPHA INDUCED REACTIONS: EVIDENCE FOR ALPHA PREFORMATION IN NUCLEI. Chevarier, A.; Chevarier, N.; Demeyer, A. (Univ., Lyon). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Measurements of continuous energy spectra and angular distributions of alpha particles emitted in proton, deuteron, ^{3}He and alpha induced reactions were performed. An analysis using the preequilibrium model succeeds in giving an overall description of particle spectra. The alpha particle in this approach being considered as an exciton, a preformation factor around 0.2 for four nucleons to be correlated as an alpha particle is found. The alpha preformation probability deduced from this analysis is independent of the proton, deuteron ^{3}He incident channel and target nucleus mass. (auth)

18987 DESCRIPTION OF ELASTIC α-PARTICLE SCATTERING BY A FOUR-PARAMETER OPTICAL POTENTIAL. Simonov, I. N.; Terenetskii, K. O.; Tokarevskii, V. V. (Kiev State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1555-1557(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1748-1751(Aug 1970).

Differential cross sections are shown for the elastic scattering of alpha particles at 27.2 MeV on nickel-60. The curves represent optical model calculations with surface absorption and bulk absorption respectively. Also the parameter values, reaction cross sections, and χ^2 are tabulated. (JFP)

18988 LIETIME OF THE 1.118 MeV STATE IN ^{65}Cu. Kaipov, D. K.; Lysikov, Yu. A.; Sverdlova, S. S.; Shubnyi, Yu. K. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1549-1551(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1742-1744(Aug 1970).

The method of nuclear resonance scattering was employed to determine the lifetime of the 1.118-MeV second excited state of ^{65}Cu. Also the angular correlations of the 1.118-MeV γ rays resonantly scattered on copper-65 are studied. (JFP)

18989 γ-RAYS OF ^{66}Ge. Dzhelepov, B. S.; Il'in, V. V.; Popova, T. I.; Prikhodtseva, V. P. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1481-1483(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1666-1669(Aug 1970).

The ^{66}Ge spectrum is reported on from 300 to 2700 keV as recorded with a Ge(Li) detector having a sensitive volume of 30 cm^3 and working into a 4906-channel analyzer. Energies and intensities of ^{66}Ge γ rays above 270 keV are tabulated. Some new lines were observed. (JFP)

18990 PROPERTIES OF ODD NUCLEI IN THE EXCITED-CORE MODEL. Erokhina, K. I.; Isakov, V. I.; Lemberg, I. Kh. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1914-1921(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2146-2153(Oct 1970).

Properties of energy levels are calculated for chromium-63,

cobalt-59, and copper-63 and -65 assuming that the properties of an odd nucleon are determined by the interaction of the odd nucleon with the core and a given form of the interaction with allowance not only for the first excited state of the core, but also for higher ones (triplet states). It is concluded from the results for the low lying levels that the excited-core model can be used to describe odd nuclei with one nucleon (or hole) outside a filled shell. (JFP)

18991 LEVELS OF ^{76}Se EXCITED IN THE DECAY OF ^{76}Br. Dzhelepov, B. S.; Dmitriev, A. G.; Zhelev, Zh.; Zhukovskii, N. N.; Moskvin, L. N.; Fominykh, V. I. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1838-1844(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2062-2069(Oct 1970).

The conversion-electron and $\gamma\gamma$-coincidence spectra of ^{76}Br was examined. Only the conversion lines of the strongest transitions could be examined. Energies and relative intensities were determined for ten conversion lines using two sources. The experimental conversion coefficients were calculated from the relative intensities of the K-conversion lines and the γ rays on the assumption that the 559 keV transition is of E2 type (this line represents two unresolved E2 transitions: $2^+ \rightarrow 0^+$ and $0^{+\prime} \rightarrow 2^+$). The relatively large value of the K conversion coefficient α_K for the 657 keV transition can evidently be attributed to an EO admixture. Relative γ-ray intensities in the coincidence spectra are given, together with earlier data on the intensities in the singles spectrum. (JFP)

18992 γ-RAY SPECTRUM OF ^{77}Br AND $\gamma\gamma$ COINCIDENCES FOLLOWING DECAY OF ^{75}Br AND ^{77}Br. Dzhelepov, B. S.; Dmitriev, A. G.; Zhukovskii, N. N.; Mozzhukhin, A. V.; Fominykh, V. I. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1845-1848 (Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2070-2073(Oct 1970).

On the basis of data on the γ-ray spectrum and the $\gamma\gamma$ coincidences a decay scheme for ^{75}Br is proposed. The three lowest levels were observed in both ^{75}Br decay and the ^{75}As(p,n)^{75}Se reaction, nor is there any doubt about the transitions between them. In particular, since the 286.5 keV transition follows immediately after the 140.9 keV transition it is convenient to normalize the (γ286.5) γ coincidences with γ286.5 to the 141 keV line. The observed lines of the γ spectra of ^{77}Br and their relative intensities are listed as well as the $\gamma\gamma$ coincidences. The selenium-75 levels are discussed. (JFP)

18993 CONVERSION-ELECTRON SPECTRUM OF ^{69}Ge. Dzhelepov, B. S.; Il'in, V. V.; Moskvin, L. N.; Popova, T. I.; Prikhodtseva, V. P.; Sokolov, I. A. (Radium Inst., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1429-1432(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1610-1613(Aug 1970).

The conversion electron spectra were examined for the strongest transitions in germanium-69. The energies, intensities, and multipole orders are tabulated. It is shown that all the transitions are of M1, E2, or E2 + M1 type. (JFP)

18994 SPECTRA OF γ RAYS FROM THERMAL-NEUTRON CAPTURE BY ^{78}Se AND ^{80}Se. Barchuk, I. F.; Bazavov, D. A.; Belykh, G. V.; Golyshkin, V. I.; Murzin, A. V.; Ogorodnik, A. F. (Inst. of Physics, Kiev). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1579-1581(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1775-1777(Aug 1970).

The spectra of the γ rays arising from the (n,γ) reaction on ^{78}Se (σ = 0.41 b) and ^{80}Se (σ = 0.6 b) were examined. Examples of the measured spectra of natural selenium and the enriched ^{78}Se and ^{80}Se samples are shown. The energies and intensities of the γ lines of ^{79}Se and ^{81}Se are shown. The resultant data relating to the γ lines of the selenium isotopes enable one to compare the results of (d,p) and (n,γ) reactions on the even-even isotopes of selenium. A comparison between the spectroscopic factors of the p levels of ^{77}Se, ^{79}Se, and ^{81}Se excited in (d,p) reactions and the reduced probabilities I_γ/E_γ^3 for E1 transitions from the capture state to these levels is shown. A clear indication is found that the capture of an s neutron by selenium isotopes is not a matter of "direct capture," which is most probable for nuclei with A $\approx$ 50, but rather involves excitation of "doorway states" which is more likely to occur for nuclei with A $\approx$ 70. (JFP)

18995 PHOTONEUTRON REACTION CROSS SECTION OF ^{55}Mn IN THE GIANT DIPOLE RESONANCE REGION. Ishkhanov, B. S.; Kapitonov, I. M.; Lazutin, E. V.; Piskarev, I. M.; Shevchenko, O. P. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1988-1991(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2228-2231(Oct 1970).

An experimental investigation was made of the photoneutron-reaction cross section of one of these nuclei (^{55}Mn), and the results are compared with calculations based on the dynamic collective theory developed by Danos, Greiner, and their collaborators. The differential photoneutron cross section was calculated from the yield curve by the Penfold-Leiss method. The cross section of ^{55}Mn for photoneutron production is shown. A number of distinct peaks at energies of 10.3, 11.4, 11.9, 13.0, 14.5, 15.8, 16.3, 17.5, 18.5, 19.4, 20.3, 21.0, 22.0, and 24.0 MeV are rated and certain resonances, principally those at 12.3, 12.7, 13.7, 14.2, 15.1, and 16.7 MeV, appear in the form of "singularities" in the cross section curve. There are also indications of additional structure at excitation energies above 22 MeV. (JFP)

18996 PHOTONEUTRON REACTION OF ^{89}Y. Ishkhanov, B. S.; Kapitonov, I. M.; Lazutin, E. V.; Piskarev, I. M.; Shevchenko, O. P. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1991-1992 (Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2232-2233(Oct 1970).

The (γ,Tn) reaction on ^{89}Y was examined in the γ-ray energy region from threshold to 29 MeV with 100 keV steps. Ten resonances in the cross section can be distinguished. (JFP)

18997 COULOMB EXCITATION OF THE 636 keV LEVEL OF ^{149}Sm AND THE 1000 keV LEVEL OF ^{77}Se. Gal'perin, L. N.; Il'yasov, A. Z.; Lemberg, I. Kh.; Firsanov, G. A. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1466-1467(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1650-1651(Aug 1970).

The 46.1 MeV C^{4+} ions were used to investigate Coulomb excitation of ^{149}Sm. In addition to the previously observed γ lines, lines were observed at 178, 208, 305, 506, 614, and 636 keV. The 178 line is emitted in a transition between the 528 and 350 keV states. The 528 keV state also emits 506 keV γ rays by transition to the 22.5 keV level. The 528, 506, and 178 keV lines have intensities in the ratio 53:55:2. The 32.4 MeV C^{4+} ions were used to investigate Coulomb excitation of ^{77}Se. In addition to the previously reported γ lines were observed at 478 and 750 keV, which are attributed to transitions to the 522 and 250 keV levels from the 1000 keV one. Various properties of the levels of each of these nuclei are briefly described. (JFP)

18998 EXCITED LEVELS OF ^{85}Sr. Basu, S. K.; Patro, A. P. (Saha Inst. of Nuclear Physics, Calcutta). J. Phys., G (London); 1: No. 8, 836-852(21 Oct 1975).

The γ ray spectra following the decay of ^{85}Y isomers (2.68 h and 4.8 h) have been investigated using a high resolution 32.2 cm^3 coaxial Ge(Li) detector. The previously proposed doublets at 614, 1400 and 2120 keV and several other unreported structures have been clearly resolved. Sixteen new γ rays have been identified in the decay work and comparatively accurate values for the energies and the relative intensities of the observed transitions are presented. In addition, in-beam γ ray measurements following the ^{85}Rb (p, nγ)^{85}Sr reaction have been made at an incident proton energy of 3.8 MeV. 23 levels have been proposed through decay studies, of which 12 levels below 1.6 MeV excitation in ^{85}Sr are evidenced by (p, nγ) measurements. New levels are proposed at energies of 785.4, 936.9, 1398.0, 1588.5, 1987.6, 2086.0, 2165.8 and 2748.4 keV. From the deduced log ft values and the observed γ decay modes, probable J^π assignments for the levels in ^{85}Sr have been made. The level structure is compared with the existing theoretical calculations. (auth)

18999 INELASTIC SCATTERING OF HEAVY IONS. Rehm, K.E.; Körner, H.J.; Richter, M.; Rother, H.P.; Schiffer, J.P.; Spieler, H. (Physik Department, Technische Universität, München, Germany). Phys. Rev. C 12: No. 6, 1945-1961 (Dec 1975).

Angular distributions and excitation functions for elastic and inelastic scattering have been measured with ^{16}O, ^{18}O, and ^{32}S projectiles on Ca, Ni, Mo, and Sn isotopes. The experimental data show oscillations in the angular distributions which are more pronounced for projectile excitations than for target excitations. These oscillations are discussed within the semiclassical model. The experimental results have been analyzed with the modified distorted-wave Born-approximation (DWBA) code DWUCK. The theoretical predictions using conventional (macroscopic form factor) DWBA calculations fail to describe the data accurately; a modification of the form factor is required to achieve a satisfactory description. (auth)

19000 EXCITED ANALOGS IN ^{62}Ni AND ^{63}Cu(p, n) AND THE WEAK-COUPLING MODEL. Wong, C.; Anderson, J.D.; Brown,

V.R.; Davis, J.C.; Grimes, S.M.; Madsen, V.A.; Poppe, C.H. Phys. Rev. C 12: No. 6, 2115-2117 (Dec 1975).

The ground- and 2^+ excited-state analog cross sections in ^{62}Ni(p, n) have been measured at bombarding energies of 16, 19, and 22 MeV. The measurements at 19 and 22 MeV confirm the weak coupling and Thankappan-True prediction of ~ 0.4 for the fractionation of the 2^+ strength into the $7/2^-$ excited analog transition in ^{63}Cu(p, n). At 16 MeV, agreement with the weak-coupling model is poor. The discrepancy is possibly due to a preequilibrium contribution to the $7/2^-$ excited analog transition in ^{63}Cu(p, n). (auth)

19001 LEVEL STRUCTURE OF ^{60}Co. Jolivette, P.L.; Goss, J.D.; Browne, C.P. (Department of Physics, University of Notre Dame, Notre Dame, Indiana 46556). Phys. Rev. C 12: No. 6, 2121-2124 (Dec 1975).

Level energies of ^{60}Co were measured using the ^{59}Co(d,p)^{60}Co reaction and the 100 cm broad range magnetic spectrograph. In order to excite nearly all states the data were taken at $\theta_{lab} \geq 60°$. Energies for 89 states having $E_x \leq 3.2$ MeV were measured with uncertainties of 1 keV or less. (auth)

19002 POLARIZATION MEASUREMENTS AND OPTICAL-MODEL POTENTIAL FOR TRITONS. Hardekopf, R.A.; Veeser, L.R.; Keaton, P.W. Jr. (Los Alamos Scientific Laboratory, University of California, Los Alamos, New Mexico 87545). Phys. Rev. Lett. 35: No. 24, 1623-1625 (15 Dec 1975).

The recent installation of a polarized-triton-ion source on the Los Alamos Scientific Laboratory tandem Van de Graaff accelerator has allowed the measurement of analyzing powers for triton elastic scattering over a wide range of angles. The data obtained from scattering polarized tritons on ^{52}Cr, ^{60}Ni, ^{90}Zr, and ^{208}Pb show unexpectedly large analyzing powers at backward angles. This leads to spin-orbit well depths greater than predicted by an optical-model analysis based on folding-model calculations. (auth)

19003 HIGH-SPIN STATES IN ^{66}Zn. Bruandet, J.F.; Agard, M.; Giorni, A.; Longequeue, J.P.; Morand, C.; Chan, T.U. (Institut des Sciences Nucléaires, B.P. 257 Centre de Tri, 38044 Grenoble Cedex, France). Phys. Rev. C 12: No. 6, 1739-1744 (Dec 1975).

The structure of ^{66}Zn has been investigated by studying the yield functions, angular distributions, and coincidence relationships of the γ rays emitted during bombardment of an enriched ^{64}Ni foil by α particles of medium energy (27 MeV). Spins up to 10h were assigned to observed states. (auth)

19004 SYSTEMATICS OF THE PROTON STRIPPING REACTION ON ^{69,71}Ga, ^{75}As, ^{79,81}Br ISOTOPES AND NUCLEAR STRUCTURE OF THE Ge-Se ISOTOPES. Ardouin, D.; Tamisier, R. (Institut de Physique de Nantes, B. P. 1044, 44-Nantes, France); Vergnes, M.; Rotbard, G.; Kalifa, J.; Berrier, G.; Grammaticos, B. Phys. Rev. C 12: No. 6, 1745-1761 (Dec 1975).

The ^{69}Ga(^{3}He, d)^{70}Ge and ^{75}As(^{3}He, d)^{76}Se reactions have been studied at 25 MeV incident energy using a split-pole spectrometer. The over-all resolution is 18–21 keV. Sixty-two ^{70}Ge levels, 16 of which observed for the first time, are populated below 5.2 MeV excitation energy. Seventy-one ^{76}Se levels are separated, 44 of which had never been observed. Angular distributions are obtained and comparison with distorted-wave-Born-approximation calculations allows parity assignment and spin limits for many levels. Spectroscopic factors are deduced for most of the observed transitions. In order to test our mixing of orbital momenta, the ^{69}Ga(α, t)^{70}Ge reaction has also been performed at 39.35 MeV incident energy. A cursory investigation of the ^{79,81}Br(^{3}He, d) reactions has been performed and systematics are drawn for the first excited levels between $N = 38$ and 46. The model previously presented to account for the strong population of the ^{72}Ge 0^+_2 level in our earlier study of ^{72}Ge with the same reaction is discussed and compared with the present results. From present and previously known experimental systematics, conclusions are drawn concerning the possibility of an oblate to prolate shape transition between $N = 36$ and 46, the softness of the nuclei in the $N = 40$ region, and the noncollective structure of the 0^+_2 state. Potential energy surfaces obtained by Hartree-Fock calculations using the Skyrme interaction are presented and confirm the above conclusions. (auth)

19005 ^{90}Zr AND ^{92}Zr: NEUTRON TOTAL AND SCATTERING CROSS SECTIONS. Guenther, P.; Smith, A.; Whalen, J. (Argonne National Laboratory, Argonne, Illinois 60439). Phys. Rev. C 12: No. 6, 1797-1808 (Dec 1975).

Total neutron cross sections of ^{90}Zr and ^{92}Zr were measured from 0.9 to 5.5 MeV and elastic and inelastic neutron scattering cross sections from 1.8 to 4.0 MeV. The inelastic neutron excitations of six states in ^{90}Zr and more than 12 in ^{92}Zr were observed. The experimental results formed the basis of an optical-statistical model interpretation including considerations of resonance width fluctuation and interference and the behavior of the optical potential near $N = 50$. Comparisons of measured and calculated cross sections suggested new spin assignments for a number of excited states. (auth)

19006 (d, p) REACTIONS IN THE CONTINUUM. Chan, K.C.; Cohen, B.L.; Shabason, L.; Alzona, J.E.; Congedo, T. (University of Pittsburgh, Nuclear Physics Laboratory, Pittsburgh, Pennsylvania 15260). Phys. Rev. C 12: No. 6, 1844-1849 (Dec 1975).

^{65}Cu,^{116}Cd(d, p) reaction cross sections in the continuum regions have been measured for deuteron energies 9, 10.5, and 12 MeV. They are compared to a theoretical calculation in which the spectroscopic factors of usual (d, p) reaction calculations for nuclear states are replaced by the strength distributions for different single neutron configurations. These distributions are Gaussian curves centered at single neutron orbits with widths proportional to their excitation energies. Good agreement is found for angular distributions and incident deuteron energy dependences, although the predicted absolute cross sections are about 50% higher than the measurements. Uncertainties in the calculations are discussed. (auth)

19007 DIRECTIONAL CORRELATIONS OF GAMMA RAYS IN ^{77}As. Cherry, R. N. Jr.; Wiedenbeck, M. L. (Michigan Univ., Ann Arbor (USA). Dept. of Physics). Nucl. Phys., A; 252: No. 2, 445-451 (10 Nov 1975).

Directional correlation measurements have been made for gamma transitions in ^{77}As following the decay of 11.30-h ^{77}Ge by using two Ge(Li) detectors. By using the method of Chow et al., mixing ratios of gamma transitions and the spins of seven levels have been deduced with only a ground-state spin of $^3/_2$ being assumed. Levels for which spins were deduced are 216 $^3/_2$, 264 $^5/_2$, 475 $^9/_2$, 632 $^5/_2$, 1189 $^7/_2$, 1458 $^3/_2$, and 1582 $^5/_2$ keV. (NL)

19008 OBSERVATION OF WIGNER CUSPS IN THE ^{64}Ni (p,gamma)^{65}Cu REACTION. Mann, F. M.; Dayras, R. A.; Switkowski, Z. E. (California Inst. of Tech., Pasadena (USA)). Phys. Lett., B; 58: No. 4, 420-422(29 Sep 1975).

Gamma-ray yield measurements are reported for the ^{64}Ni (p,gamma)^{65}Cu reaction over an energy range which includes several low-lying (p,n) thresholds. A strong decrease in the (p,gamma) yield at the opening of the neutron channels is interpreted as a superposition of several Wigner cusps. Statistical model calculations successfully reproduce the observations. (NL)

19009 HIGH-ENERGY γ-RAYS IN ^{87}Kr FOLLOWING THE DECAY OF ^{87}Br. Tovedal, H.; Fogelberg, B. (Forskningsraadens Lab., Studsvik (Sweden)). Nucl. Phys., A; 252: No. 2, 253-259 (10 Nov 1975).

The high-energy γ-ray spectrum following the decay of ^{87}Br has been studied in order to identify primary transitions from neutron unbound states to the ground state of ^{87}Kr. Nine γ-rays with energies higher than the neutron separation energy were observed. The results are compared with the corresponding spectrum of delayed neutrons. (NL)

19010 MAGNETIC MOMENTS OF THE ANOMALOUS PARITY $^5/_2^+$ 13.3-keV STATE OF ^{73}Ge. Haas, H.; Ivanov, E.; Recknagel, E. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F.R. Germany). Bereich Kern- und Strahlenphysik). Phys. Lett., B; 58: No. 4, 423-424(29 Sep 1975).

The g-factor of the 3-μs, $^5/_2^+$ level in ^{73}Ge was determined to be $g = -0.0376 \pm 0.0010$ by the time-differential perturbed angular correlation method. The magnetic moment of the anomalous-parity state is discussed on the basis of the extended quasiparticle–phonon coupling model. (NL)

19011 MEASUREMENT OF THE INCLUSIVE FORWARD NEUTRON SPECTRUM PRODUCED IN PROTON–COPPER INTERACTIONS AT 24 GeV/c. Ansorge, R. E.; Carter, J. R.; Mount, R. P.; Neale, W. W.; Raja, R.; Rushbrooke, J. G. (Cambridge Univ. (UK). Cavendish Lab.). Nucl. Phys., B; 93: No. 3, 439-444(20 Oct 1975).

Data are presented on the inclusive spectra of neutrons produced in the forward direction by the interactions of 23.85-GeV/c protons in a copper target. The results are in good agreement with the predictions of the triple-Regge model. (NL)

Nuclear Properties and Reactions, $90 \leq A \leq 149$

Refer also to abstracts 18534, 18695, 18801, 18835, 18837, 18838, 18918, 18934, 18948, 18951, 18953, 18961, 18962, 18974, 18988, 18997, 18999, 19002, 19006, 19023, 19064, 19083, 19092, 19188, 19211, and 19239.

19012 (BNL-NCS-50446, pp 150-157) ^{115}In(n,n')/sup 115m/In REACTION FOR ENDF/B-III. Sher, R. (Stanford Univ., CA). Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N. Y. (USA)).

An analysis is made of the energy dependence of the cross section for excitation of the 4.5 hour, 335 keV isomeric state in ^{115}In by neutron inelastic scattering. (SDF)

19013 (BNL-NCS-50446, pp 158-166) EVALUATION OF ^{115}In(n,gamma)^{116}In FOR ENDF/B-IV. Schmittroth, F. (Hanford Engineering Development Lab., Richland, WA). Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N. Y. (USA)).

An evaluation has been made of the ^{115}In(n,gamma)/sup 116m/In reaction, emphasizing resolved resonance parameters and smooth capture cross sections. Both the 54.2 minute state at 0.126 MeV and the 2.2 second state at 0.289 MeV are included. (SDF)

19014 (BNL-NCS-50446, pp 167-173) ^{127}I(n,2n)^{126}I CROSS-SECTION FOR ENDF/B-IV. Sher, R. (Stanford Univ., CA). Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N. Y. (USA)).

An evaluation is made of the ^{127}I(n,2n)^{126}I cross section from threshold to about 18 MeV. (SDF)

19015 (CEA-CR-2, pp 79-80) RESULTS OBTAINED AT SATURNE. Saudinos, J. [nd]. (In French)

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8-10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The proton scattering results obtained in the synchrotron Saturne are summarized: target, reaction, energy of the incident proton, nature of the levels studied, limits of the transfer momentum range measured, and corresponding elastic scattering cross-sections. (FR)

19016 (CEA-N-1791, pp 27-31) REACTIONS INDUCED BY 64 MeV ^{16}O PROJECTILES ON ^{116}Sn. Conjeaud, M.; Harar, S.; Lepine, A.; Da Silveira, E.; Volant, C. [nd]. (In French)

In Department of Nuclear Physics. Progress report 1 October 1973-30 September 1974. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

Elastic and inelastic scattering of ^{16}O + ^{116}Sn are analyzed in order to obtain information on the optical model and deformation parameters. Angular distributions of two proton transfer leading to the 0^+ (g.s.) and 2^+ (0.606 MeV) levels of ^{118}Te are nearly similar in contrast with the predictions of the two-step process mechanism. (FR)

19017 (COO-2696-001) DETERMINATION OF NEUTRON CAPTURE CROSS SECTIONS AND RESONANCE PARAMETERS FOR VANADIUM AND THE ISOTOPES OF TELLURIUM. Progress Report, June 1, 1975-November 30, 1975. Winters, R. R. (Denison Univ., Granville, Ohio (USA)). Dec 1975. Contract E(11-1)-2696. 5p. Dep. NTIS $3.50.

Analysis of ^{51}V(n,gamma) data taken at the forty-meter flight station at the Oak Ridge Electron Accelerator has been essentially completed over the neutron energy (laboratory) range 2.5-100 keV. Resonance parameters for some seventy-five resonances have been extracted. In particular, radiative widths not previously measured have been obtained for many resonances above 50 keV. Data analysis will be continued at least up to neutron energy 150 keV. As part of our continuing study of mass-dependent behavior of resonance parameters, a continuing interest in the astrophysical applications of (n,gamma) cross sections, and as a test of recent modifications to our analysis computer codes, data analysis (begun before the initiation of this contract) of ^{205}Tl (n,gamma) and ^{205}Tl (n,x) data was continued. This work is now essentially completed over the neutron energy range 2.5-100 keV. Departures from predictions of the statistical model for the resonance parameters have been observed. After considerable effort, it has been concluded that the Denison computer system is not adequate for certain aspects of the required data analysis. Alternate approaches to enable data analysis to be done during the academic year at Denison are being considered. The analysis of the Te(n,gamma) data is barely under way and will be the primary focus of efforts over the coming year. However, the tellurium (n,gamma) data (for mass numbers 122, 124, 125, 126, 128 and 130) have been processed from the time-of-flight form to effective cross section and a normalization to a recent natural tellurium (n,gamma) measurement has been completed. (auth)

19018 (ORO-4856-26, pp 234-235) IS THE FORM FACTOR OF THE ALPHA PARTICLE OPTICAL POTENTIAL ENERGY DEPENDENT. Budzanowski, A.; Grotowski, K.; Strzalkowski, A. (Jagellonian Univ., Krakow). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19019 (ORO-4856-26, pp 409-410) ALPHA-CLUSTER PICK-UP REACTIONS ON RARE-EARTH NUCLEI. Milder, F. L.; Janecke, J.; Becchetti, F. D. (Univ. of Michigan, Ann Arbor). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Systematics of the (d,^{6}Li) reaction on rare-earth nuclei have been studied at E/sub d/ equals 35 MeV. Alpha-particle correlations appear to be important for these nuclei. (auth)

19020 (ORO-4856-26, pp 417-418) NEUTRON BLOCKING IN THE (d,^{6}Li) ALPHA-PARTICLE TRANSFER REACTION. Becchetti, F. D.; Chua, L.; Janecke, J. (Univ. of Michigan, Ann Arbor). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The (d,^{6}Li) alpha-transfer reaction has been studied on even-A and odd-A tin isotopes at E/sub d/ equals 35 MeV. The odd-A isotopes exhibit large blocking effects (approximately factor two) similar to those observed in (p,t) reactions. (auth)

19021 (ORO-4856-26, pp 589-590) BINARY AND TERNARY FISSION OF SUPERHEAVY NUCLEI. Schultheis, H.; Schultheis, R. (Univ., Tuebingen, Ger.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Calculated ternary fission barriers of superheavy nuclei are found to exceed the binary barriers by only 10-35 percent. The importance for the discovery of superheavy nuclei is discussed. (auth)

19022 (ORO-4856-26, pp 599-600) ELASTIC SCATTERING OF HEAVY-IONS FROM EVEN ISOTOPES OF TIN. Durell, J. L.; Christy, A.; Grant, I. S. (Univ. of Manchester, Eng.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Heavy ions of different nuclear structure have been elastically scattered from the even isotopes of tin. The projectiles used are the closed shell nucleus ^{40}Ca, and the neutron rich isobar ^{40}Ar; the deformed nucleus ^{20}Ne; and the higher z, fp-shell nuclei ^{56}Fe and ^{63}Cu. (auth)

19023 RADIATION FROM ^{120}I, ^{120*}I, ^{122}I, AND ^{126}I, AND THE NATURE OF THE LEVELS IN EVEN-EVEN TELLURIUM ISOTOPES (A = 120, 122, 124, 126). Gabrakov, S.; Zhelev, Zh.; Zaitseva, N. G.; Penev, I.; Sabirov, S. S. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1825-1834(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2048-2058(Oct 1970).

About one hundred γ transitions following decay of ^{120}I (T = 85 min.) and 120*I (T = 53 min.) were found. The K conversion-electron spectra of ^{120}I and ^{120*}I were investigated for the first time. The results obtained are presented. The β^+ spectrum of ^{120}I was also examined. The ^{122}I spectrum was examined. The γ and conversion-electron spectra of ^{126}I were measured and the β^- spectrum remeasured. The levels of tellurium -120, -122, -124, and -126 are discussed. (JFP)

19024 DECAY OF ^{100}Pd AND ENERGY LEVELS IN ^{100}Rh. Anton'eva, N. M.; Grigor'ev, E. P.; Zolotavin, A. V.; Nikitin, M. K.; Sergeev, V. O.; Protasova, L. F. (Leningrad State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1901-1904(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2131-2134(Oct 1970).

The γ-ray spectrum of ^{100}Pd was examined with a Ge(Li) spectrometer, and the conversion-electron spectrum with a $\pi\sqrt{2}$ β-spectrometer (0.2% resolution). The γ-ray spectrum was measured. The energies and intensities are given and γ-ray and conversion-electron relative intensities, energies, conversion coefficients, and multipolarities for transitions in ^{100}Rh are also given. (JFP)

19025 MAGNETIC QUADRUPOLE TRANSITION IN NUCLEI. Foucher, R.; Letessier, J. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1867-1869(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2092-2095(Oct 1970).

For the M2 transitions discussed, transition probabilities T_{exp} were calculated from the experimental data, and theoretical probabilities T_W and T_N were calculated using the independent-particle model with spherical (Moszkowski) and deformed (Nilsson) potentials. Hindrance factors were also determined. Deformed nuclei without fixed deformation are considered. (JFP)

19026 CONVERSION-ELECTRON SPECTRUM OF ^{96}Nb. Ageev, V. A.; Gavrilyuk, V. I.; Kupryashkin, V. T.; Latyshev, G. D.; Lyutyi, I. N.; Maidanyuk, V. K.; Makovetskii, Yu. V.; Feoktistov, A. I. (Inst. of Physics, Kiev). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1433-1436(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1614-1617(Aug 1970).

Individual portions of the conversion-electron spectrum of ^{96}Nb that are associated with the doublet structure of the transitions found previously and are possible according to the decay scheme of ^{96}Nb are examined. The measured portions of the ^{96}Nb conversion-electron spectrum are shown. Doublet K conversion lines of transitions at about 350, 720, and 810 keV were observed, but the K conversion line of the 241.3 keV transition is apparently single. The results of the measurements are given. The energies of all the observed transitions were determined within ± 0.3 keV. (JFP)

19027 LIFETIMES OF EXCITED STATES IN ^{101}Ru. Lan'ko, E. V.; Dombrovskaya, G. S. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1585-1586(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1782-1783(Aug 1970).

Delayed coincidences were used to measure the lifetimes of the 127.2- and 325.0-keV excited levels of ^{101}Ru. The lifetime of the 325 keV level has not been measured before. The levels are excited by K capture in ^{101}Rh (half-life 3 yr). (JFP)

19028 EFFECT OF p−n INTERACTIONS IN ODD-A NUCLEI. Peker, L. K. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1535-1539(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1727-1731(Aug 1970).

A study is made of properties of the anomalous $^{7}/_{2}^{+}$ states of the odd nuclei ^{95}Tc, ^{99}Rh, and ^{111}Ag. It is concluded that the lower anomalous $^{7}/_{2}^{+}$ states are probably genealogically associated either with the three-particle states of the $(g_{9/2})^{3,5}$ configuration (with seniority $\nu = 3$) or with strongly collectivized states resulting from interaction between a nucleon and phonon. (JFP)

19029 γ RAYS OF ^{107}In, ^{108}*In, AND ^{108}In. Didorenko, V. A.; Andreev, Yu. A.; Burmistrov, V. R. (Inst. of Nuclear Physics, Alma-Ata, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1575-1578(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1771-1774(Aug 1970).

The gamma spectrum of indium-107 was examined from 60 to 3000 keV, and that of indium-108 from 200 to 4500 keV. The energies and relative intensities of the lines are tabulated for indium-107, -108, and *-108. (JFP)

19030 THREE-PARTICLE ISOMERIC STATES OF THE $[j^3]$ TYPE. Peker, L. K.; Kharitonov, Yu. I. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1996-2000(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2239-2243(Oct 1970).

The mechanism for an isomeric state with the configuration of the $\{j^3\}$ type and the features of the multiplets of three-particle configurations of the type $\{j_p^2 j_n\}$ or $\{j_p j_n^2\}$ are considered. The isomeric states of tin-117 and astatine-211 are considered. It is noted that the excellent agreement between the theoretical and experimental spectra indicates that other configurations play only a small role. (JFP)

19031 MULTICOMPONENT ANOMALOUS STATES OF NUCLEI. Peker, L. K. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1975-1980(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2214-2219 (Oct 1970).

The properties of the ground and isomeric states of odd-odd nuclei produced from anomalous odd nuclei by the addition and subtraction of one nuclei are considered. Various intermediate-mass nuclei are considered. (JFP)

19032 EXCITATION FUNCTIONS FOR (p,n) AND (p,2n) REACTIONS ON TIN ISOTOPES. Skakun, E. A.; Klyucharev, A. P.; Rakivnenko, Yu. N.; Romanii, I. A. (Physical-Technical Inst., Kharkov). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1939-1943(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2174-2178(Oct 1970).

The excitation functions for the reactions ^{116,117,118,119,120,122}Sn (p,n) and ^{117,118,119,120}Sn(p,2n) using incident protons with energies up to 21 MeV. Cross sections are also discussed. The well-known method of induced activity was used in the measurements. (JFP)

19033 γ RADIATION OF ^{147}Eu. Vavryshchuk, Ya.; Govorek, T.; Kliishchevska, K. (Curie-Skladowska Univ., Lublin). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1922-1926(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2154-2158 (Oct 1970).

Transitions that are already reliably accommodated in the decay scheme of ^{147}Eu are considered. The relative γ-ray intensities are given as measured with the Ge(Li) spectrometer, and properties of the transitions are discussed. The scandium-147 levels are also discussed. (JFP)

19034 PRODUCTION OF RADIOACTIVE DEPOSITS ON CONDUCTING SUBSTRATES IN GAS-PHASE NUCLEAR REACTIONS. Babenkov, M. I.; Bobykin, B. V.; Petukhov, V. K. (Inst. of Nuclear Physics, Alma-Ata, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1495-1497(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1683-1685 (Aug 1970).

A method of preparing a conducting substrate bearing radioisotopes made by irradiating a gas target in an accelerator is described. The product nuclei will be present in the gas as positive ions, and an electric field will cause the ions to deposit on the negative electrode. The method was tested in the preparation of cesium β sources by exposure of natural xenon to 9-MeV protons in a cyclotron. (JFP)

19035 EXCITATION OF ISOMERIC ACTIVITIES IN INDIUM ISOTOPES BY (p,n)-REACTIONS. Skakun, E. A.; Klyucharev, A. P.; Rakivnenko, Yu. N.; Romanii, I. A. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 5, 733-738 (May 1975). (In Russian)

Cross sections for excitation of the long-living isomers ^{110m,g}In, ^{111}In, ^{112m,g}In, ^{113m}In, ^{114m}In, and ^{116m}In through the (p,n)-reaction were measured by the activation technique within the bombarding energy range up to 9 MeV. Statistical model calculations of isomeric cross-section ratios are carried out, using the spin cut-off parameter values obtained from three various models: Fermi gas model, independing pairing model and superconduction model. The values of the theory parameters are found at which the experimental results are in the best agreement with the theory predictions. For even-A In isotopes the calculated results are in agreement with the experiment for the nuclear moment of inertia values smaller than the rigid body value for $\alpha = A/8$. An anomalous high experimental cross section was determined for the production of ^{113m}In in the studied bombarding energy range. The analysis indicates it is connected with the particular level scheme in ^{113}In. (7 figures, 1 table) (auth)

19036 SYSTEMATICS OF THE DENSITY OF NEUTRON LEVELS IN THE REGION A = 130 to 200. Pshenichnyi, V. A. (Inst. of Nuclear Research, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 4, 684-687(Apr 1975). (In Russian)

On the basis of the independent quasiparticle model at temperatures above the phase transition point, calculations were made of the density of neutron levels in the region A = 130 to 200. A comparison was made with experimental values. Such an approach satisfactorily describes a significant part of the data in the region examined. (tr-auth)

19037 NUCLEAR γ TRANSITIONS SPECTRUM IN A DIATOMIC MOLECULE. Letokhov, V. S.; Minogin, V. G. (Inst. of Spectroscopy, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1569-1581(Nov 1975). (In Russian)

The γ spectrum of a nucleus in a diatomic molecule due to

variation of the electron–vibrational-rotational state of the molecule on emission or absorption of a γ quantum by the nucleus is considered. It is shown that the most intense γ spectrum components are due to alteration of the vibrational-rotational state of the molecule. The emission and absorption spectra of the ^{127}I nucleus in the H ^{127}I molecule is calculated, and the feasibility of its detection is discussed. (auth)

19038 POSITIVE PARITY SPECTRUM OF ^{90}Zr. Dedes, C.; Irvine, J. M. (Univ. of Manchester, Eng.). J. Phys., G (London); 1: No. 8, 865-873(21 Oct 1975).

A shell model calculation using a two-particle-two-hole basis is introduced for the examination of the positive parity spectrum of ^{90}Zr. Only proton excitations are considered, with the additional restriction that the two-proton particles are excited from the Of-1p shell to the Og $^9/_2$ orbital. Two realistic interactions are used, and second-order corrections are found to be important for the construction of the "effective" interaction. The results of the calculation give a good account for the spacings of the excited states, but predict a too depressed ground state. This indicates that additional configurations may contribute significantly for a better interpretation of the positive parity spectrum of ^{90}Zr. (auth)

19039 ANGULAR CORRELATION MEASUREMENTS IN ^{165}Er. Fuia, H.; Ion-Mihai, R.; Morozov, V. A.; Muminov, T. M.; Budzynski, M.; Holbaev, I. (Joint Inst. for Nuclear Research, Dubna, USSR). Rev. Roum. Phys.; 20: No. 6, 561-564(1975).

The gamma-gamma angular correlation measurements aimed at determining the spins for some excited levels and the mixing parameters Q for several gamma-transitions in ^{165}Er are reported. The obtained spin values are $^1/_2$ and $^3/_2$ for 589.7 keV and 1427.1 keV levels, respectively. (auth)

19040 DECAY OF THE $^{11}/_2^-$ ISOMERIC STATE ^{103}Ru. Bartsch, H.; Huber, K.; Kneissl, U.; Krieger, H. (Giessen Univ. (F.R. Germany). Abt. Grossgeraete (Angewandte Kernphysik)). Nucl. Phys., A; 252: No. 1, 1-7(3 Nov 1975).

The energy-level structure of ^{103}Ru was studied by investigating the decay of the $^{11}/_2^-$ isomeric state and the ^{103}Tc β-decay produced by the reactions $^{104}Ru(\gamma,n)^{103}Ru$ and $^{104}Ru(\gamma,p)^{103}Tc$. By using an intrinsic Ge detector with high resolution, Ru K X-rays and low-energy γ-rays (E < 350 keV) were measured, and the γ energy and half-life, determined. From the measured intensity ratios of the Ru K x-rays and corresponding γ lines it could be deduced that the isomeric transition is a low-energy one of about 24 keV and has multipolarity M2. The half-life of the $^{11}/_2^-$ state was determined as $T_{\frac{1}{2}} = 1850 \pm 60$ μsec. There is no considerable hindrance for the decay of the isomeric state. It is concluded that the deformation of the nucleus is the same in the $^{11}/_2^-$ state as in the ground state. (NL)

19041 LIFETIMES OF THE $^{17}/_2^-$ ISOMERS IN ODD-PROTON N = 82 NUCLEI. Fromm, W. D.; Funke, L.; Schilling, K. D. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Phys. Scr.; 12: No. 1-2, 91-94(Aug 1975).

The lifetimes of the $^{11}/_2^-$ states in ^{145}Eu, ^{143}Pm, ^{141}Pr, and ^{139}La and an additional lifetime in ^{143}Pm were determined. The results are relevant for a discussion of the amount of mixing of one- and three-quasiparticle states. (NL)

19042 EXCITED STATES IN ^{103}Pd. Dietrich, W.; Nyman, B.; Johansson, A.; Baecklin, A. (Uppsala Univ. (Sweden). Fysiska Institutionen). Phys. Scr.; 12: No. 1-2, 80-90(Aug 1975).

The level scheme of ^{103}Pd has been investigated by means of gamma-ray and internal conversion measurements in the ^{103}Rh (p, nγ) reaction and ^{103}Ag decay. A revised and much enlarged ^{103}Pd level scheme has been constructed. Tentative spin–parity assignments, derived from relative excitation functions, transition multipolarities and log-ft values, have been given for the majority of the 25 levels observed in the reactions. A half-life of 25 ± 2 ns was measured for the $^{11}/_2^-$ level at 784 keV. (NL)

19043 FISSION OF MEDIUM AND HEAVY NUCLEI INDUCED BY ^{40}Ar FROM 160 TO 300 MeV. Cross Sections. Tamain, B.; Ngo, C.; Peter, J. (Paris-11 Univ., 91 - Orsay (France). Inst. de Physique Nucleaire); Hanappe, F. (Physique Nucleaire Experimentale, Universite Libre de Bruxelles, Bruxelles, Belgique). Nucl. Phys., A; 252: No. 1, 187-207(3 Nov 1975).

Cross sections have been measured for argon-induced fission following full momentum transfer. Two incident energies (between 200 and 300 MeV) have been used for ^{238}U, ^{209}Bi, ^{165}Ho and natural Mo targets. For a natural Sb target, the fission excitation function has been measured from 160 to 300 MeV. The experimental method was an improved version of the angular correlation method, which takes into account kinetic energies and time-of-flight correlations. This allowed us to eliminate fission events following transfer reactions and also random events. Under the assumption that the angular distribution is that characteristic of fission fragments issuing from a compound nucleus (close to $1/\sin\theta$), the fission cross sections range from 10 ± 1 mb for Ar + Mo at 200 MeV to 1030 ± 120 mb for Ar + U at 300 MeV. When necessary, these cross sections have been added to the cross sections for the formation of evaporation-residue nuclei measured by other authors in order to obtain complete-fusion cross sections. The deduced critical angular momentum for formation of a complete fusion nucleus is found to be an increasing function of the mass and energy of the incoming particle. These results are used to test the concept of a critical distance of approach which would govern fusion between two complex nuclei. The threshold of the excitation function measured for Ar + Sb is compared with calculations based on the statistical model for the competition between fission and evaporation. The calculations include the effects of multiple-chance fission and of angular momentum on fission widths. (NL)

19044 STUDIES OF THE β-DECAY OF ^{96}Y AND THE LEVEL SCHEME OF ^{96}Zr. Sadler, G.; Khan, T. A.; Sistemich, K.; Grueter, J. W.; Lawin, H.; Lauppe, W. D.; Selic, H. A.; Shaanan, M. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik); Schussler, F.; Blachot, J. Nucl. Phys., A; 252: No. 2, 365-380(10 Nov 1975).

The β-decay of ^{96}Y has been investigated by the three on-line separators JOSEF, LOHENGRIN and OSIRIS. Evidence for two decay modes is given. The half-lives of the two β-decaying levels are 6.0 ± 0.3 sec and 10.0 ± 0.3 sec. The 6.0-sec state is assumed to be the ground state of ^{96}Y with spin and parity $J^\pi = 0^-$. The value of Q_β is 6200 ± 200 keV. The decay scheme of ^{96}Zr, based on coincidence measurements, has been established and is in agreement with the results of the nuclear reaction experiments. (NL)

19045 TOTAL KINETIC ENERGIES IN THE FISSION OF ^{101}Rh, ^{110}Cd, ^{119}I AND ^{128}Ba NUCLEI. Namboodiri, M. N.; Natowitz, J. B.; Chulick, E. T.; Das, K.; Webb, L. (Texas Agricultural and Mechanical Univ., College Station (USA). Cyclotron Inst.). Nucl. Phys., A; 252: No. 1, 163-172(3 Nov 1975).

Singles and coincidence experiments with solid state detector telescopes have been used to determine the total fragment kinetic energies in the symmetric fission of ^{101}Rh, ^{110}Cd, ^{119}I and ^{128}Ba nuclei produced in reactions induced by 197-MeV ^{12}C projectiles. These kinetic energies are found to be in excellent agreement with the predictions of Davies et al. based upon a dynamic liquid drop model calculation. For the reactions of ^{12}C with Ag, the dependence of the kinetic energy release on angular momentum has been explored. The increase in kinetic energy with increasing angular momentum is found to be ≤ 0.7 keV/$(\hbar/2\pi)^2$. (NL)

19046 A NEW TIN ISOTOPE–^{106}Sn. Burminskii, V.N.; Grebenshchikov, I.V.; Kovrigin, O.D.; Sychikov, G.I. (Nuclear Physics Institute, Kazakh Academy of Sciences). JETP Lett. 22: No. 2, 54-55 (20 July 1975).

A new radioactive isotope of tin, with atomic mass 106 and half-life $T_{1/2}$=1.9±0.3 min, was obtained and identified using the extracted beam of the isochronous cyclotron of the Nuclear Physics Institute of the Kazakh Academy of Sciences and the reaction $^{104}Cd(^3He, 3n)$. The energies and relative intensities of the ^{106}Sn γ rays were measured. (auth)

19047 NEUTRON RESONANCE CAPTURE IN ^{138}Ba. Musgrove, A. R. deL.; Allen, B. J.; Bolderman, J. W. (Australian Atomic Energy Commission Research Establishment, Lucas Heights); Macklin, R. L. (Oak Ridge National Lab., Tenn. (USA)). Nucl. Phys., A; 252: No. 2, 301-314(10 Nov 1975).

The neutron capture cross section of ^{138}Ba has been measured with high resolution to 100 keV, and resonance parameters have been extracted. A number of new levels are observed. The s-wave radiative width is found to be six times the p-wave radiative width, and is also considerably larger than for other nuclei in this mass region. Valence capture and enhanced decay to single-particle final states could account for the large s-wave radiative strength. A large positive correlation between GAMMA/sub n/^{0} and GAMMA/sub gamma/ for ten s-wave levels was found (rho equals 0.67). The following average resonance parameters were deduced: [D] equals 7.5 +- 1.5 keV, S_0 equals (0.9 +- 0.4) x 10^{-4}, S_1 approximately equal to 0.5 x 10^{-4}; [GAMMA/sub gamma/] /sub s/ equals 310 +- 25 MeV and [GAMMA/sub gamma/]/sub p/ equals 47 +- 5 MeV. Evidence for a predominant direct capture mechanism for thermal capture is presented. (NL)

19048 DIRECTION CORRELATIONS OF gamma-RAYS IN ^{143}Pr. Cherry, R. N. Jr.; Wiedenbeck, M. L. (Michigan Univ., Ann Arbor (USA). Dept. of Physics). Nucl. Phys., A; 252: No. 2, 437-444(10 Nov 1975).

Directional correlation measurements have been made for gamma transitions in ^{143}Pr following the decay of 33.0-h ^{143}Ce by using two Ge(Li) detectors. Correlation coefficients are reported for twelve cascades, of which coefficients for five cascades are

previously unreported. Deduced are mixing ratios for thirteen transitions and spins and parities for the following levels: 57 $^{5}/_{2}^{+}$, 351 $^{3}/_{2}^{+}$, 490 $^{5}/_{2}^{+}$, 722 $^{3}/_{2}^{+}$, 739 $^{1}/_{2}^{-}$, 938 $^{3}/_{2}^{+}$, and 1160 $^{3}/_{2}^{+}$ keV. (NL)

19049 BAND STRUCTURE IN $^{131\ 132\ 133}$Ba OBSERVED BY (^{12}C,xn) REACTIONS. Gizon, J.; Gizon, A.; Horen, D. J. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). Nucl. Phys., A; 252: No. 2, 509-523 (10 Nov 1975).

High-spin levels in Ba isotopes are observed in the reactions $^{122\ 124}$Sn(^{12}C,3n gamma)$^{131\ 133}$Ba and ^{124}Sn(^{12}C,4n gamma)^{132}Ba. They are studied by in-beam spectroscopic methods such as prompt and delayed spectra, excitation functions, gamma–gamma coincidences and angular distributions. Bands are found on the $^{11}/_{2}^{-}$ isomeric state in ^{133}Ba and on the $^{3}/_{2}^{-}$ isomeric state in ^{131}Ba which are in agreement with the structure of other nuclei with 77 and 75 neutrons and with prolate deformation. A negative-parity band with both even- and odd-spin members from 5$^-$ to 9$^-$ is found in ^{132}Ba. (NL)

19050 ACTIVATION CROSS SECTIONS FOR REACTIONS OF ^{109}Ag INDUCED WITH ^{40}Ar IONS. Hille, M. (Technische Univ. Muenchen, Garching (F.R. Germany). Physik-Dept.); Hille, P. (Oesterreichische Akademie der Wissenschaften, Vienna. Inst. fuer Radiumforschung und Kernphysik); Gutbrod, H. H. (Gesellschaft fuer Schwerionenforschung m.b.H., Darmstadt (F.R. Germany)); Blann, M. (Rochester Univ., N. Y. (USA). Dept. of Chemistry). Nucl. Phys., A; 252: No. 2, 496-508 (10 Nov 1975).

Activation cross sections for reactions of enriched targets of ^{109}Ag with ^{40}Ar ions of 288 and 228 MeV have been determined by gamma-ray spectroscopy. Yields of evaporation residues and low-mass transfer products have been measured. Evaporation residue yield-mass distributions are compared with three sets of statistical model results. The calculation based on a rotating liquid drop model with fission competition is in very good agreement with experimental results. It is shown that the yields are inconsistent with a mechanism of incomplete fusion plus evaporation. (NL)

19051 EFFECTS OF THE TRITON *D* STATE IN (*d*, *t*) REACTIONS. Knutson, L.D. (University of Washington, Seattle, Washington 98195); Hichwa, B.P.; Barroso, A.; Eiró, A.M.; Santos, F.D.; Johnson, R.C. Phys. Rev. Lett. 35: No. 23, 1570-1573 (8 Dec 1975).

Measurements of the tensor analyzing powers for (*d*,*t*) reactions on ^{118}Sn and ^{208}Pb are presented. It is shown that the measured quantities are sensitive to the *D*-state components in the triton wave function. The magnitudes of the observed analyzing powers are in good agreement with predictions obtained from a triton *D*-state wave function calculated in first-order perturbation theory. (auth)

19052 NEUTRON HOLE STATES OF ^{99}Mo. Bindal, P.K.; Youngblood, D.H.; Kozub, R.L. (Cyclotron Institute and Physics Department, Texas A&M University, College Station, Texas 77843); Hoffmann-Pinther, P.H. Phys. Rev. C 12: No. 6, 1826-1833 (Dec 1975).

The (*p*, *d*) and (*d*, *t*) reaction on ^{100}Mo have been used at bombarding energies of ~ 40 MeV to populate neutron hole state of ^{99}Mo. Excitation energies and angular distributions were measured for levels up to 4.25 MeV in excitation. A distorted wave Born approximation analysis was used to make *l* assignments and to obtain spectroscopic factors. Three distinct groups of weakly excited levels, one corresponding to $l = 4$ and two corresponding to $l = 1$, were observed lying above 2.15 MeV excitation. A hole-core-coupling model is used to predict the properties of ^{99}Mo and fair agreement with the experiment is obtained. (auth)

19053 HIGH-SPIN STATES IN ^{109}Cd. Meyer, M.; Béraud, R.; Danière, J.; Rougny, R. (Institut de Physique Nucléaire, Université Claude Bernard Lyon-I and IN2P3, 43, Bd du 11 novembre 1918, 69621 Villeurbanne, France); Rivier, J.; Tréherne, J.; Barnéoud, D. Phys. Rev. C 12: No. 6, 1858-1864 (Dec 1975).

Levels of ^{109}Cd populated by ^{108}Pd(α, $3n\gamma$)^{109}Cd have been studied by measuring γ-ray excitation functions, direct γ spectra, γ-γ coincidences, and γ-ray angular distributions and by performing lifetime measurements. An intense γ-ray cascade has been observed, built on the $11/2^-$ intrinsic state and involving states of spin $11/2^-$, $15/2^-$, $19/2^-$, $23/2^-$, and $(27/2^-)$. A decay level scheme is proposed including states up to 4502 keV. (auth)

19054 DETERMINATION OF THE SIGN AND MAGNITUDE OF THE NUCLEAR QUADRUPOLE INTERACTION BY β-γ DIRECTIONAL CORRELATIONS. Raghavan, R.S.; Raghavan, P.; Kaufmann, E.N. (Bell Laboratories, Murray Hill, New Jersey 07974). Phys. Rev. C 12: No. 6, 2022-2032 (Dec 1975).

Experiments are reported which demonstrate that the *sign* and magnitude of the quadrupole interaction of excited nuclear states can be reliably determined by means of time-differential β-γ directional correlations with radioactive sources embedded in noncubic single crystals. The 828 keV level of ^{115}In and the 247 keV level of ^{111}Cd, fed by an allowed and a unique first-forbidden β decay, respectively, have been investigated by this method. The coupling constants e^2qQ/h of these levels in Cd metal at 298° K are: $-146(5)$ MHz for ^{115}In and $+125(4)$ MHz for ^{111}Cd. The positive coupling constant for ^{111}Cd in Cd coupled with a positive quadrupole moment Q of this level implies a positive electric field gradient in Cd confirming recent theoretical predictions. The negative e^2qQ for the ^{115}In level in Cd metal correspondingly indicates a negative Q for this level in conformity with its description as a member of a $K = 1/2$ rotational band. The paper includes a discussion of the major concepts underlying the various methods available now for determination of the sign of e^2qQ. Also, a detailed account of theoretical formulas necessary to evaluate allowed and forbidden β-γ perturbed angular correlations and a brief discussion of the significance of the technique for further studies of nuclear quadrupole effects in materials are given. (auth)

19055 SHAPE IMPLICATIONS OF UNHINDERED $11/2- \rightarrow 11/2-$ β DECAYS IN THE REGION WITH $N < 82$ AND $Z > 50$. van Klinken, J.; Feenstra, S.J. (Laboratorium voor Algemene Natuurkunde and Kernfysisch Versneller Instituut Rijksuniversiteit, Groningen, The Netherlands). Phys. Rev. C 12: No. 6, 2111-2114 (Dec 1975).

Unhindered $11/2^- \rightarrow 11/2$ β-ray transitions with log*f* values of 5.0 to 5.4 have been observed in the decay of ^{139}Eu, ^{139}Sm^{m}, and a new isotope ^{135}Pm. These transitions show no noticeable retardation and are not "shape forbidden." The shape of $11/2^-$ states with odd N is not very different from the (prolate) shape of adjacent $11/2^-$ states with odd Z. (auth)

19056 SEARCH FOR FRAGMENT EMISSION FROM NUCLEAR SHOCK WAVES. Poskanzer, A.M.; Sextro, R.G.; Zebelman, A.M. (Lawrence Berkeley Laboratory, University of California, Berkeley, California 94720); Gutbrod, H.H.; Sandoval, A.; Stock, R. Phys. Rev. Lett. 35: No. 25, 1701-1704 (22 Dec 1975).

Energy spectra and angular distributions have been measured of ^{3}He and ^{4}He fragments emitted from Ag and U targets, bombarded with 2.7-GeV protons, and 1.05-GeV/nucleon α particles and ^{16}O ions. All cross sections increase dramatically with projectile mass. No narrow peaks are found in the angular distributions or in the energy spectra. (auth)

19057 L_3 CONVERSION OF THE 2.38-keV ISOMER IN ^{90}Nb. Campbell, J.L.; Martin, B. (Max Planck Institut für Kernphysik, Heidelberg, Germany); Schmidt-Ott, W.D.; Smend, F.; Raff, U. Phys. Rev. Lett. 35: No. 19, 1259-1262 (10 Nov 1975).

The 3.8% decrease in half-life of the 2.38-keV ^{90m}Nb isomer when Nb is converted from metal to a fluoride complex is one of the largest reported chemical effects on the internal conversion process. We present experimental and theoretical evidence that this effect is not due, as had been conjectured, to the "switching off" of L_3 conversion through increased L_3 binding energy. (auth)

19058 OBSERVATION OF GIANT GAMOW-TELLER STRENGTH IN (*p*,*n*) REACTIONS. Doering, R.R.; Galonsky, A.; Patterson, D.M.; Bertsch, G.F. (Cyclotron Laboratory, Department of Physics, Michigan State University, East Lansing, Michigan 48824). Phys. Rev. Lett. 35: No. 25, 1691-1693 (22 Dec 1975).

In ^{90}Zr(p,n)^{90}Nb spectra for E_p=35 and 45 MeV, we observe a strong enhancement of the T=4 continuum over a range of excitation energies (full width at half-maximum of 4.2±0.4 MeV) centered at 8.4±0.3 MeV. The data are consistent with an interpretation of the broad peak as a $(\pi g_{7/2}, \nu g_{9/2}^{-1})_{1+}$ excitation which corresponds to the giant magnetic-dipole resonance. Similar structure is observed near the isobaric analog state of ^{48}Ca, ^{120}Sn, and ^{208}Pb. (auth)

19059 LONGITUDINAL ELECTRON POLARIZATION FOR A SECOND-FORBIDDEN BETA DECAY. Doty, D.R. (California State University, Northridge, Northridge, California 91324); Neill, E.I. Jr. Phys. Rev. C 12: No. 6, 1994-1998 (Dec 1975).

Electron polarization from the second-forbidden β decay in ^{137}Cs has been investigated by use of a lens spectrometer. Møller scattering from a hydrogen-annealed Supermendur foil of 2×10^{-2} mm thickness was employed to measure the polarization. Fast-slow coincidence techniques were used. Solid state detectors, a small area scattering foil, and a highly collimated spectrometer defined the scattering geometry and helped to reduce background. Analysis of the data was performed from a two-parameter recording to eliminate chance coincidence events. Two independent techniques of measurement resulted in $P_e = -1.0 \pm 0.2$. A substantial deviation from the value of $P_e = -v/c = 0.92$, which would be expected for allowed decays, was not observed. (auth)

19060 TWO-PARTICLE, ONE-HOLE STATES IN ANTIMONY NUCLEI AND THE DECAY OF ^{121}Te^{m,g}. Meyer, R.A.; Lanier, R.G.; Larsen, J.T. (Lawrence Livermore Laboratory, University of California, Livermore, California 94550). Phys. Rev. C 12: No. 6, 2010-2012 (Dec 1975).

The decay of $^{121}Te^{m,g}$ and the concomitant γ rays from levels of ^{121}Sb have been measured. The decay of $^{121}Te^{g}$ is found to populate levels at (J^{π}/log*ft* value given in parentheses) 507.59 keV (3/2⁺/6.87) and 573.14 keV (1/2⁺/6.11), while the decay of $^{121}Te^{m}$ is found to populate levels at g.s. (5/2⁺/—), 37.138 keV (7/2⁺/logf_1t = 9.63), 946.99 keV (9/2⁺/9.93), 1024 keV (7/2⁺/log$f_1t \geq$ 12.35), 1035.53 keV (9/2⁺/9.70), 1139.29 keV (11/2⁺/7.85), and 1144.65 keV (9/2⁺/11.19). These levels and their decay properties are found to be described well by recent calculations which include two-particle, one-hole configurations (2p-1h). Decay of the 2p-1h 1/2⁻ and 3/2⁻ levels in ^{119}Sb populated in the decay of ^{119}Te are also presented. (auth)

19061 NEUTRON CAPTURE CROSS SECTION OF NIOBIUM-93 FROM 2.6 TO 700 keV. Macklin, R. L. (Oak Ridge National Lab., TN). Nucl. Sci. Eng.; 59: No. 1, 12-20(Jan 1976).

The neutron capture cross section of stable ^{93}Nb was measured by time-of-flight methodology at the Oak Ridge Linear Electron Accelerator. Individual resonances were parameterized to 7.4 keV with energy resolution less than or equal to 0.14 percent full-width-at-half-maximum. The average cross section was deduced from 3 to 700 keV with an accuracy estimated at 3 to 5 percent SD. The average data to 100 keV are well fitted by strength functions, but the fluctuations about the fit are not consistent with an energy-dependent level density proportional to 2J + 1 beyond 20 keV. 3 figures, 2 tables (auth)

19062 EXPERIMENTAL INVESTIGATIONS ON THE DECAY OF ^{147}Nd. Fellmann, S. Marburg, Ger.; Univ. Marburg (1971). 93p. (In German). INIS.

Thesis.

A few controversal points regarding the decay scheme of ^{147}Nd were solved. It could, e.g., be shown that the γ-lines at 720 keV do not belong to the decay of ^{147}Nd but to that of ^{148m}Pm which sometimes occurs in the irradiation of ^{146}Nd with neutrons. Furthermore, it was shown that the existence of the direct β-transition between the ground states of ^{147}Nd and ^{147}Pm can be excluded. Finally, the form factors for three partial spectra of ^{147}Nd were determined. (DE)

Nuclear Properties and Reactions, 150 ≤ A ≤ 189

Refer also to abstracts 18838, 18948, 18951, 19019, 19021, 19025, 19031, 19036, 19043, 19080, 19092, and 19233.

19063 (ISN-75-16) STUDY OF THE $^{176}Lu(n,\gamma)^{177}Lu$ REACTION USING A γ BAND-FILTER SPECTROMETER. Geinos, D.; Kern, J.; Piepenbring, R. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires). 1975. 30p. INIS.

The γ-ray spectrum from the $^{176}Lu(n,\gamma)^{177}Lu$ reaction has been investigated in the energy range of 450 to 1420 keV using a newly developed γ band-filter spectrometer. A total of 153 transitions have been observed. Improvements to the ^{177}Lu scheme are suggested, in particular the γ decay of several levels of the 1/2-[530] and 3/2-[532] rotational bands is proposed. Special attention has been given to the Coriolis coupling between the two latter bands and the 1/2-[541] band. Results on a complementary investigation of the $^{175}Lu(n,\gamma)^{176}Lu$ reaction are presented. (FR)

19064 (ISN-75-26) EFFECTIVE NEUTRON-PROTON INTERACTION IN RARE EARTH ODD-ODD NUCLEI. Boisson, J. P. (Grenoble-1 Univ., 38 (France). Inst. des Sciences Nucleaires; Grenoble-1 Univ., 38 (France)). 1975. 151p. (In French). INIS.

The effective neutron-proton interaction V(np) in the rare earth odd-odd deformed nuclei is studied. The parameters of the effective interaction are determined from least square fits of calculated matrix elements compared to the ones extracted from experiment. These fits show the existence of a long range repulsive component as well as the importance of the even term of the tensor part of V(np). Some information is obtained concerning the influence of the choice of the sample of experimental data, of the average field and finally, of the radial shape of the effective interaction. Some predictions are made concerning as yet unconfirmed V(np) matrix elements. (FR)

19065 PROPERTIES OF LOW-LYING LEVELS OF EVEN ISOTOPES OF Pt. Erdahl, B. R. (Washington Univ., St. Louis); Finger, M.; Foucher, R.; Hasson, J. P.; Jastrzebski, E. J.; Johnson, A.; Henk, R.; Siffert, P.; Astner, H.; Kjehlberg, A.; Patzelt, P. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1452-1457(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1635-1640 (Aug 1970).

Some new evidence is presented on the properties of low-lying levels of light even isotopes of Pt. The excited states of even isotopes of Pt with mass numbers from 192 to 182 were examined in the decay of odd isotopes of Au. The individual γ spectra, the conversion-electron spectra, and two-dimensional γγ coincidences were measured. The results from the last were used only for ^{188}Pt and ^{190}Pt. Only the individual spectra were measured for other Pt isotopes, and the results are preliminary. The relations between the decay branches were deduced on the assumption that the transitions are pure E2, pure E0, or E2 + E0 mixtures, i.e., that the possible contribution from M1 transitions is negligible (except when it has been established directly). Also discussed are spins and parities of some new levels. (JFP)

19066 INTRANUCLEAR PARAMETERS FOR CONVERSION OF THE K-FORBIDDEN 57.54 keV E1 TRANSITION IN ^{180}Hf. Gvozdev, V. S.; Grifor'ev, V. N.; Sergeenkov, Yu. V. (Physical-Technical Inst., Kazan). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1492-1494(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1680-1682 (Aug 1970).

The absolute internal conversion coefficients were determined for the L and M subshells for the 57.54-keV transition were determined by comparing the intensities of the gamma rays taken from previous work and the internal-conversion electrons for the 57.54- and 93.33-keV transitions. The intranuclear conversion parameters for the 75.54-keV transition were deduced from earlier results for the relative internal conversion coefficients for the L and M subshells. It is concluded that intranuclear conversion is responsible for the anomalous internal conversion coefficient for this K-forbidden 57.54-keV transition on the basis of the agreement between the results from the absolute and relative internal conversion coefficients for the L and M subshells. (JFP)

19067 LEVEL SCHEME FOR ^{188}Ir. Bakiev, S. A.; Kordyukevich, V. O.; Kryukova, L. N.; Murav'eva, V. V.; Sorokin, A. A. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1562-1566(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1757-1760 (Aug 1970).

An attempt was made to locate the 42-keV transition in two independent ways: by measuring γγ coincidences with Ge(Li) detectors in both channels, and by determining T(55) from (e^{-55})(γ424) coincidences. Properties of this level scheme are discussed. The results are consistent with a previous decay scheme. (JFP)

19068 COINCIDENCES OF ^{160}Ho γ RAYS. Grigor'ev, E. P.; Zvolski, J.; Tikhonov, N. A.; Fominykh, V. I. (Leningrad State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1835-1837(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2059-2061(Oct 1970).

Data on coincidences with the 86.8-keV gamma rays together with intensity limits on strong transitions not coinciding the γ86.8 are given as well as data on coincidences with γ197. As a result of these investigations the existence of a number of excited states of ^{160}Dy were experimentally confirmed, and several new levels were found. (JFP)

19069 DETERMINATION OF THE MULTIPOLARITY OF SOME γ TRANSITIONS IN ^{153}Eu. Metskhvarishvili, R. Ya.; Elizbarashvili, M. A.; Gachechiladze, V. M.; Bodokiya, L. V. (Tbilisi State Univ., USSR). Bull Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1993-1994(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2234-2236 (Oct 1970).

The spectrum of conversion electrons from ^{153}Sm corresponding to 69.67, 75.34, 103.18, and 108.0 keV transitions in ^{153}Eu was examined. A part of the decay scheme of ^{153}Sm is shown. The L_I and L_{II} lines of the 69.67-, 75.34-, 103.17-, and 108.0-keV transitions; also $L_I : L_{II} : L_{III}$ conversion-electron intensity ratios for transitions in ^{153}Eu are given. (JFP)

19070 CONVERSION-ELECTRON SPECTRUM OF ^{182}Re. Ageev, V. A.; Gavrilyuk, V. I.; Kupryashkin, V. T.; Latyshev, G. D.; Lyutyi, I. N.; Makovetskii, Yu. V.; Feoktistov, A. I. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1904-1914(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2135-2145 (Oct 1970).

The conversion-electron spectrum of the 12.7-hr and 64-hr isomers of ^{182}Re was examined using the $\pi\sqrt{2}$ spectrometer (ρ = 50 cm). The transition energies and the relative intensities of some conversion lines of 64-hr ^{182}Re in the region of transition energies E_γ below 400 keV are given. The portion of the spectrum containing the K286.58 lines and the L peaks of the 229.32 keV transition is shown. Transition energies in the region $E_\gamma > 400$ keV and the relative intensities of some of the corresponding K conversion lines are given for both ^{182}Re isomers conversion coefficients and multipolarities are shown for tungsten-182 transitions. (JFP)

19071 INVESTIGATION OF SOME CONVERSION LINES OF ^{184}Re, ^{184*}Re, AND ^{183}Re. Ageev, V. A.; Gavrilyuk, V. I.; Kupryashkin, V. I.; Latyshev, G. D.; Lyutyi, I. N.; Maidanyuk, V. K.; Makovetskii, Yu. A.; Feoktistov, A. I. (Inst. of Physics, Kiev). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1892-1897(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2121-2126(Oct 1970).

The present investigation of the conversion-electron spectra of ^{184}Re and ^{184*}Re was undertaken in order to check the multipole composition of the strong transitions and to obtain additional information about the ^{184*}Re decay scheme. Some conversion lines of ^{183}Re were also investigated. While investigating the ^{184,184*}Re conversion-electron spectrum above 400 keV a new transition was found with an energy of 483 keV and a half-life of 38 days. From the intensity of the K conversion line of this transition and the upper bound to the intensity of the corresponding γ rays a lower bound of 1.1×10^{-2} was found for the K conversion coefficient. The most probable multipolarity for this transition is E2. (JFP)

19072 DECAY OF ^{150}Pm AND THE LEVEL SCHEME FOR ^{150}Sm. Grigor'ev, E. P.; Zolotavin, A. V.; Sergeev, V. O.; Tikhonov, N. A.; Fominykh, M. I. (Leningrad State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1849-1857(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2074-2082 (Oct 1970).

The γ rays and γ-γ coincidences following decay of ^{150}Pm at a resolution of 4.5 to 6.0 keV were examined using 6-, 10-, and 30-cm^3 Ge(Li) detectors at the Joint Institute for Nuclear Research. Data on the energies and intensities of the ^{150}Pm γ rays are presented. The energies of the γ transitions below 2 MeV were determined within ~1 keV, and those in the 2 to 3 MeV region, within 5 keV. The γ-γ coincidences in ^{150}S were analyzed. The single γ spectrum, relative intensities, and coincidences are discussed, and a new level at 1894 MeV is proposed. The ^{150}Pm conversion electron spectrum was also examined. Conversion coefficients and some multipole types were determined. (JFP)

19073 NEW EXPERIMENTAL DATA ON THE DECAY OF ^{169}Lu AND ^{170}Lu. Dzhelepov, B. S.; Ter-Nersesyants, V. E.; Uchevatkin, I. F.; Shestopalova, S. A. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1858-1862(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2083-2087 (Oct 1970).

The conversion-electron spectra of ^{169}Lu and ^{170}Lu was investigated, using an ion-free $2\pi\sqrt{2}$ spectrometer under such conditions that the width of a line at half maximum amounted to 0.08-0.12% in the energy region above 500 keV. The results of the measurements are presented. Transition energies and conversion-electron relative intensities for ^{169}Lu and ^{170}Lu are listed and discussed. (JFP)

19074 LAWS GOVERNING THE CROSS SECTIONS FOR PRODUCTION OF RARE-EARTH ISOTOPES IN THE SPALLATION OF TANTALUM BY 660-MeV PROTONS. Gromov, K. Ya.; Lavrukhina, A. K.; Kuznetsova, R. I.; Mikhailov, M.; Strusny, H. (Inst. of Geochemistry and Analytical Chemistry, Moscow). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1467-1471(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1652-1655(Aug 1970).

The applicability of a previous formula for calculating the production cross section was verified by bombarding tantalum with protons and deriving general laws governing the distribution of the cross sections for formation of spallation products. On calculating the yields of these products by previous formulas serious discrepancies were found. (JFP)

19075 REDUCED PROBABILITIES OF M1 TRANSITIONS BETWEEN LEVELS OF THE GROUND-STATE ROTATIONAL BAND IN THE RARE EARTHS. Gal'perin, L. N.; Il'yasov, A. Z.; Lemberg, I. Kh. (Physical-Technical Inst., Kazan). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1461-1462(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1644-1645(Aug 1970).

Previous results on reduced M1 transition probabilities between levels of rare earth ground-state rotational bands are briefly described. (JFP)

19076 BETA-GAMMA DIRECTIONAL CORRELATION MEASUREMENT IN ^{194}Ir. Priyadarsini, D. K.; Vema Reddy, B.; Sastry, D. L. (Andhra Univ., Waltair, India). Curr. Sci. (India); 44: No. 22, 793-794(20 Nov 1975).

The angular correlation of the $1^- \rightarrow 2^+$(1920 keV, β) $\rightarrow 0^+$(329 keV, γ) cascade is measured integrally and at two beta energies. The results show isotropic correlation and indicate the validity of the ξ or coulomb approximation for the 1920 keV beta transition of ^{194}Ir. (auth)

19077 BETA SPECTRUM OF ^{175}Yb. Mallikharjuna Rao, P.; Mallikarjuna Rao, B.; Narasimha Rao, C.; Mathews, R.; Venkata Reddy, K. (Andhra Univ., Waltair, India). Curr. Sci. (India); 44: No. 21, 755-756(5 Nov 1975).

The study of ^{175}Yb is interesting from the point of view of the Nilsson model, as this nucleus lies in the deformed region $150 \leq A \leq 190$. The shape data on the $^1/_2^- \rightarrow {}^9/_2^+$ beta transition of ^{175}Yb is scanty and any attempt to measure the same by the usual singles method results in large uncertainties because of the presence of the conversion electron lines in the same energy region besides the weak intensity (~3%) of the transition. The present work aims at a reasonably good estimate of the shape of the beta group in ^{175}Yb employing a coincidence beta ray spectrometer which eliminates the interferences. (auth)

19078 ROTATIONAL BANDS IN ^{153}Eu. Dracoulis, G. D.; Leigh, J. R.; Slocombe, M. G.; Newton, J. O. (Australian National Univ., Canberra). J. Phys., G (London); 1: No. 8, 853-864(21 Oct 1975).

Rotational bands in ^{153}Eu have been populated using the ^{154}Sm(d, 3n) reaction over a range of deuteron energies. The γ decay of the excited states has been studied and the level scheme established up to a spin of $^{23}/_2^+$ in the $^5/_2^+$ [413] band, possibly $^{27}/_2^-$ in the $^5/_2^-$ [532] band and $^{13}/_2^+$ in the $^3/_2^+$ [411] band. The $^5/_2^-$ band is irregularly spaced in contrast to the $^5/_2^+$ band, in agreement with the predictions of a Coriolis coupling calculation based on the Nilsson model. However, the calculation fails to reproduce the observed phase of irregularities in the $^3/_2^+$ band. (auth)

19079 MEASUREMENT OF SPIN-DEPENDENT NEUTRON SCATTERING AMPLITUDES OF ^{159}Tb BY NEUTRON DIFFRACTION IN ANTIFERROMAGNETS AT ULTRA-LOW TEMPERATURES. Akopyan, G. G.; Alfimenkov, V. P.; Lason, L.; Ovchinnikov, O. N.; Sharapov, E. I. (Joint Inst. for Nuclear Research, Dubna, USSR). Zh. Eksp. Teor. Fiz.; 69: No. 3, 777-782(Sep 1975). (In Russian).

Spin-dependent scattering amplitudes of nuclei are measured by unpolarized neutron diffraction in antiferromagnetic targets at ultra-low temperatures. The spin amplitude difference $a_+ - a_-$ for ^{159}Tb is measured in a diffraction experiment with the NSP-30 pulsed reactor and a ^{3}He - ^{4}He dilution refrigerator: $a_+ - a_- = -(0.35 \pm 0.14)$ fm. The value obtained for the spin-incoherent cross section is σ_{inc}(Tb) = 5 ± 4 mb. (auth)

19080 GAMMA-RAY ANGULAR DISTRIBUTIONS AND PARITY TESTS IN THE DECAYS OF POLARIZED ^{173}Lu AND ^{174}Lu^{m,g}. Krane, K.S. (Department of Physics, Oregon State University, Corvallis, Oregon 97331); Olsen, C.E.; Rosenblum, S.S.; Steyert, W.A. Phys. Rev. C 12: No. 6, 1999-2009 (Dec 1975).

Angular distributions of 18 γ rays have been measured following the decays of ^{173}Lu and ^{174}Lu^{m,g} polarized at low temperatures in the ferromagnetic cubic Laves-phase metal $ZrFe_2$. The magnetic moments of the oriented parent states are deduced to be $|\mu(^{173}\text{Lu})| = (2.34 \pm 0.09)\ \mu_N$, $|\mu(^{174}\text{Lu}^g)| = (1.94 \pm 0.28)\ \mu_N$, and $|\mu = (^{174}\text{Lu}^m)| = (2.34 \pm 0.33)\ \mu_N$. The spin of the 1518-keV level of ^{174}Yb is shown unambiguously to be 6. Multipole mixing ratios are deduced for a number of ^{173}Yb and ^{174}Yb γ-rays, and several interband *E2/M1* mixing ratios are compared with values deduced from a Coriolis mixing calculation. The 0°-180° asymmetries of the angular distributions of some of the strongly hindered ^{174}Yb transitions have been observed in a search for the presence of parity mixing effects; no such effects were seen. A possible empirical correlation between γ-ray

hindrance and the magnitude of parity-violating effects is pointed out. (auth)

19081 MAGNETIC MOMENT OF THE $I^{\pi} = 25/2^-$ ISOMER IN ^{179}Hf AND ANOMALOUS ORBITAL PROTON g FACTOR. Hübel, H.; Freitag, K. (Institut für Strahlen und Kernphysik, Universität Bonn, West Germany); Schoeters, E.; Silverans, R.E.; Vanneste, L.; Naumann, R.A. Phys. Rev. C 12: No. 6, 2013-2015 (Dec 1975).

The magnetic moment of the $I^{\pi} = 25/2^-$ isomeric state at 1106 keV in ^{179}Hf was measured by the technique of low-temperature nuclear orientation. From the result $\mu(25/2) = (7.43 \pm 0.34)\,\mu_N$ the value $g_l = 1.08 \pm 0.05$ for the effective proton g_l factor is deduced. (auth)

19082 RESIDUAL INTERACTIONS IN FOUR-QUASIPARTICLE $K^{\pi}=14^-$ ISOMER IN ^{176}Hf. Khoo, T.L.; Bernthal, F.M.; Warner, R.A. (Cyclotron Laboratory and Departments of Physics and Chemistry, Michigan State University, East Lansing, Michigan 48824); Bertsch, G.F.; Hamilton, G. Phys. Rev. Lett. 35: No. 19, 1256-1259 (10 Nov 1975).

We have for the first time located and identified a four-quasiparticle isomer in a deformed nucleus. Its energy may be used as a test for the effective interaction between quasiparticles. We can account for the energy quite well with a simple δ-function interaction, but not with an interaction derived from Brueckner theory. (auth)

19083 SPECTROSCOPY ON THE GAMMA DECAY OF HIGHLY EXCITED HIGH-SPIN STATES BY ANGULAR-CORRELATION AND FEEDING-TIME MEASUREMENTS. Trautmann, W.; Proetel, D.; Häusser, O.; Hering, W.; Riess, F. (Sektion Physik der Universität München, 8046 Garching, West Germany). Phys. Rev. Lett. 35: No. 25, 1694-1697 (22 Dec 1975).

We have studied the pre-yrast γ decay of high-spin states in Yb isotopes excited highly above the yrast line in oxygen-induced xn reactions on Sm targets. We measured energy spectra, γ-ray multiplicities, angular correlations, and feeding times. The multiplicities increase with the γ de-excitation energy. The γ-ray anisotropy indicates a dominant quadrupole character of the de-excitation γ continuum. Hindered feeding times into the ground-band states were observed for ^{168}Yb but not for the decoupled states in ^{169}Yb. (auth)

19084 HIGH-SPIN STATES IN ^{165}Tm. Foin, C.; Andre, S.; Barneoud, D. (Institut des Sciences Nucléaires, Centre de Tri, 38044 Grenoble Cedex, France). Phys. Rev. Lett. 35: No. 25, 1697-1701 (22 Dec 1975).

We have studied the properties of the four rotational bands developed in ^{165}Tm for high spin values. The $1/2^-$ [541] is the only one which does not show the backbending effect. These results are in agreement with other recent experiments showing the role of the $h_{9/2}$ protons in the backbending effect. A strong $\Delta K=3$ coupling between $1/2^+$ [411] and $7/2^+$ [404] bands has been found. (auth)

19085 TIME-DIFFERENTIAL-FREE HYPERFINE FIELD MEASUREMENT AT LOW RECOIL VELOCITIES. Dar, Y.; Gerber, J.; Loew, R.; Vivien, J.P. (Centre de Recherches Nucléaires, 67037, Strasbourg, France and Faculty of Physics, Technion, Technion City, Haifa, Israel). Phys. Rev. C 12: No. 6, 1771-1779 (Dec 1975).

A time-differential plunger technique has been used to observe the temporal attenuation of a γ-ray angular distribution. Nuclei of ^{152}Sm were Coulomb excited by 3 and 4 MeV α particles. A dominant static hyperfine interaction was observed from which a magnetic field at the nucleus of $2.6 \leqslant H(0) \leqslant 2.9$ MOe was deduced. This value is in agreement with the field calculated in the *LS* scheme. The static interaction may originate in a number of one- and two-electron processes that occur at the target surface. (auth)

19086 LEVEL STRUCTURE OF ^{173}Yb FROM THE ^{171}Yb(n, gamma) REACTION. Greenwood, R. C.; Reich, C. W. (Aerojet Nuclear Co., Idaho Falls, Idaho (USA)); Vegors, S. H. Jr. (Idaho State Univ., Pocatello (USA)). Nucl. Phys., 252: No. 2, 260-292 (10 Nov 1975).

The energy-level structure of the nucleus ^{172}Yb has been studied using the ^{171}Yb(n, gamma) reaction with both thermal and 2-keV neutrons. Gamma-ray energy and intensity measurements were made using Ge(Li) detectors. From these data, a neutron separation energy of 8020.1 +- 0.5 keV has been determined for ^{172}Yb. In addition, a level scheme is proposed for ^{172}Yb. Where possible, these states have been grouped into rotational bands. A total of fourteen such rotational bands with band-head energies below 2.2 MeV are contained in the proposed level scheme. Because of the averaging feature of the 2 keV neutron-capture data, it is believed that all the positive-parity states with I equals 0, 1 and 2 with energies below 2.3 MeV in ^{172}Yb have been identified in this study. (NL)

19087 SOME DECAY PROPERTIES OF ^{183}Ir. Ladenbauer-Bellis, I. M. (Yale Univ., New Haven, Conn. (USA). Heavy Ion Accelerator Lab.); Bakhru, H.; Sen, P. (State Univ. of New York, Albany (USA)). Nucl. Phys., A; 252: No. 2, 524-532(10 Nov 1975).

The isotope ^{183}Ir was produced at the Yale Heavy Ion Accelerator via the ^{176}Lu(^{12}C,4n)^{183}Ir reaction and from the decay of ^{183}Pt, which was formed in the ^{169}Tm(^{18}F,5n)^{183}Pt reaction. The half-life of ^{183}Ir was found to be 55 +- 5 min. Singles and coincidence gamma-ray measurements were performed using 30-40 cm^3 Ge(Li) detectors. X-ray measurements were carried out using an intrinsic Ge detector. The following gamma-rays were found to belong to the decay of ^{183}Ir:30.8, 87.7, 96.2, 102.2, 107.7, 136.8, 165.7, 194.5, 228.5, 236.7, 250.6, 254.4, 282.4, 286.1, 296.3, 314.4, 319.1, 342.2, 347.7, 392.4, 411.2, 457.7, 461.9, 498.4, 617.4, 655.1, 670.8, 692.2, 706.1, 724.8, 800.1 and 896.7 keV. A tentative decay scheme for ^{183}Ir is proposed verifying levels in ^{183}Os. (NL)

19088 E0 TRANSITIONS FROM A K EQUAL 0^+ BAND IN ^{162}Dy. Edvardson, L. O.; Westerberg, L.; Mårdueme, G. C. (Uppsala Univ. (Sweden). Fysiska Institutionen). Nucl. Phys., A; 252: No. 1, 103-108(3 Nov 1975).

The decay of ^{162}Ho has been studied by means of gamma-ray, conversion electron and gamma-electron coincidence spectroscopy. A K equals 0^+ bandhead is established at 1400.3 keV, and the ratio of E0 to E2 transition probabilities is measured. Comparison is made with various models. (NL)

19089 LEVEL STRUCTURE OF ^{188}Os. Morgen, P.; Onsgaard, J. H. (Odense Univ. (Denmark)); Nielsen, B. S.; Soendergaard, C. (Kongelige Veterinaer- og Landbohoejskole, Copenhagen (Denmark)). Nucl. Phys., A; 252: No. 2, 477-495 (10 Nov 1975).

The level structure of ^{188}Os has been studied by (d,p), (d,t) and (d,d′) reaction spectroscopy at E_d = 12.1 MeV. Assignments of a number of levels at excitation energies below approximately 1700 keV are given. The assignments are discussed in terms of a unified model based on the Nilsson model including pairing, rotational motion and attenuated Coriolis coupling. Deviations between predicted and experimental excitation energies and wave functions are generally found to be consistent with trends observed in ^{187}Os and in the odd W isotopes. Evidence for the existence of collective non-rotational states is found from the (d,d′) reactions. Results of (^{3}He,α) and high resolution γ-ray and conversion electron studies were also included at various stages of the investigation to supplement the data from the deuteron-induced reactions. Comparisons between calculated and measured B(E2) values are found to indicate an intrinsic quadrupole moment of the ground-state band of approximately 5.0 b, in agreement with values in adjacent even Os isotopes. Details of the Coriolis coupling calculations are given. (NL)

19090 DECAY OF 80s ^{156}Tm. Aguer, P.; Liang, C. F.; Libert, J.; Paris, P.; Peghaire, A. (CSNSM Bat. 104, 91406 Orsay, France); Charvet, A.; Duffait, R.; Marguier, G. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire). Nucl. Phys., A; 252: No. 2, 293-300(10 Nov 1975).

The level structure of the 88-neutron nucleus $^{156}_{68}$Er has been investigated from the EC and β^+ decay of ^{156}Tm ($T_{1/2}$ = 80s). Mass-separated samples were obtained from the Orsay on-line separator. γ-ray spectra, conversion electron spectra, and γ-γ bidimensional coincidences were performed by using semiconductor detectors. Members of the β and γ bands are proposed. The possible superposition of the 0^+ β level and the 2^+ γ level at 930.5 keV is discussed. (NL)

19091 ANOMALOUS ROTATIONAL ENERGIES AND TRANSITION PROBABILITIES AT HIGH SPIN IN THE GROUND-STATE BAND IN ^{159}Ho. Forsblom, I.; Hjorth, S. A.; Spalek, A. (Research Institute for Physics, Stockholm 50, Sweden). Nucl. Phys., A; 252: No. 2, 315-332(10 Nov 1975).

Levels with spin values up to 35/2 in the ground-state band of ^{159}Ho are populated when a ^{159}Tb target is bombarded with 49 MeV α-particles. The observed pattern of rotational energies is discussed within a model where a quasiparticle is coupled to a rotor with a variable moment of inertia. The analysis suggests that the core exhibits back-bending similar to the behavior in ^{160}Er and ^{158}Dy. However, the angular velocity giving back-bending is larger than in adjacent even nuclides unless the introduced ad hoc attenuation of the Coriolis force disappears at high spin or, more likely, unless the matrix elements of J^2 are also reduced. This uncertainty associated with the motion of the odd particle precludes the analysis of small effects of the back-bending mechanism due to the blocking of an $h_{11/2}$ orbital. The relative γ-ray intensities support the notion that g_R decreases with increasing values of spin. Furthermore, in the region of back-bending an additional drop of the E2/M1 branching ratio suggests that the B(E2) values are here reduced by about 50%. (NL)

19092 NEGATIVE PARITY BANDS IN ^{150}Ru AND ^{152}Sm AND THE INTERACTING BOSON APPROXIMATION. De Voigt, M. J. A.; Sujkowski, Z.; Chmielewska, D.; Jansen, J. F. W.; van Klinken, J.; Feenstra, S. J. (Rijksuniversiteit Groningen

(Netherlands). Kernphysisch Versneller Instituut). Phys. Lett., B; 59: No. 2, 137-141(27 Oct 1975).

Ground-state band members up to $J^{\pi} = 10^{+}$ in ^{100}Ru and up to 14^{+} in ^{150}Sm and odd-spin negative-parity states up to 15^{-} in both nuclei have been identified from $(\alpha,4n)$ in-beam γ-ray and conversion electron spectra. The data are interpreted in terms of interacting quadrupole and octupole bosons. (NL)

19093 OBSERVATION OF NUCLEAR ROTATIONAL SPECTRA IN PION CAPTURE ON ^{165}Ho AND ^{175}Lu. Ebersold, P.; Aas, B.; Dey, W.; Eichler, R.; Leisi, H. J.; Sapp, W. W.; Walter, H. K. (Eidgenoessische Technische Hochschule, Zurich (Switzerland). Lab. fuer Hochenergiephysik). Phys. Lett., B; 58: No. 4, 428-430(29 Sep 1975).

In x-ray spectra of pionic atoms of ^{165}Ho and ^{175}Lu the authors observed nuclear γ-rays of Dy and Yb isotopes, respectively, arising from the pion capture reactions ^{165}Ho(π^{-},xn) $^{165-x}$Dy* and ^{175}Lu(π^{-},xn) $^{175-x}$Yb* where x = 1,3,5,7,9,11. (NL)

Nuclear Properties and Reactions, 190 ≤ A ≤ 219

Refer also to abstracts 18801, 18906, 18934, 18953, 18986, 19002, 19021, 19030, 19043, 19051, 19058, 19123, 19187, 19188, 19190, 19221, and 19225.

19094 (BNL-NCS-50446, pp 174-191) ^{197}Au(n,gamma)^{198}Au REACTION FOR ENDF/B-IV. Goldberg, M. D.; Mughabghab, S. F. Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N. Y. (USA)).

The ^{197}Au neutron capture cross section is reevaluated for neutron energies greater than 25 keV using new available data. (SDF)

19095 (ORO-4856-26, pp 597-598) STRONGLY DAMPED COLLISIONS IN THE ^{84}Kr + ^{209}Bi REACTION. Viola, V. E. Jr. (Univ. of Maryland, College Park); Wolf, K. L.; Unik, J. P.; Huizenga, J. R.; Birkelund, J.; Freiesleben, H. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Information on a new reaction mechanism, characterized by strongly damped collisions (SDC), is presented for bombardments of ^{209}Bi with ^{84}Kr ions from the Berkeley SuperHILAC. This process accounts for a significant fraction of the reaction cross section in interactions between heavy target nuclei and projectiles of ^{40}Ar and heavier. The exit channel properties of the strongly damped collisions exhibit the following features: two fragments are emitted with masses near those of the target and projectile, although exchanges of several nucleons can occur; strong damping of the energy degree of freedom is observed; fragment energies are characteristic of deformed fission fragments, representing an attenuation of 100-150 MeV in the entrance channel energy, and the angular distribution for the ^{84}Kr-like product is strongly peaked at an angle near the classical grazing angle. Measurements have been conducted with 600-MeV and 714-MeV ^{84}Kr ions. These are compared with the work of Hanappe et al. at 525 MeV. (auth)

19096 CONVERSION-ELECTRON SPECTRUM OF ^{194}Au. Ageev, V. A.; Gavrilyuk, V. I.; Kupryashkin, V. T.; Latyshev, G. D.; Lyutyi, I. N.; Makovetskii, Yu. V.; Feoktistov, A. I. (Inst. of Physics, Kiev). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1436-1444(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1618-1626 (Aug 1970).

In order to refine the decay scheme of ^{194}Au individual parts of the spectrum were examined. The energies and relative intensities of the K lines measured, and characteristics of the levels between which the transitions take place (these assignments are based mainly on the decay scheme of ^{194}Au) are given. Multipolarities are found, and spins and parities are discussed. (JFP)

19097 NEW ISOTOPES ^{190}Tl AND ^{188}Tl. Wandlik, J.; Zaitseva, N. G.; Mate, Z.; Mahunka, J.; Mahunka, M.; Fenes, T. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1472-1475(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1656-1660(Aug 1970).

The intensity decay for gamma transitions accompanying the decay of thallium-190 and parts of the decay curves for thallium-188 and -190 are shown. It is concluded that thallium-190 has a metastable state as well as a ground state and their lifetimes are determined. The energy levels of the two studied nuclei are discussed. (JFP)

19098 POSITIVE-PARITY HOLE STATES IN ODD NUCLEI WITH Z, N = 83, 85, 87. Peker, L. K.; Voronkov, Yu. P. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1869-1873(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2096-2100 (Oct 1970).

It was recently shown that the most probable and most important reason for the decrease in the excitation energy of $d_{\frac{5}{2}}$ hole levels in nuclei with A = 40 to 50 is the interaction of the $d_{\frac{5}{2}}$ hole with the $f_{\frac{7}{2}}$ nucleons. It is pointed out that an analogous situation may be obtained in the excitation of hole levels from closed shells with N = 82 or Z = 82 in odd nuclei. Various nuclei are discussed. (JFP)

19099 MEASUREMENT BY A MICROWAVE METHOD OF THE LIFETIMES OF NUCLEAR STATES EXCITED IN α DECAY. Korolev, G. A.; Vorob'ev, A. A.; Zalite, Yu. K. (Ioffe Inst. of Physics and Tech., Leningrad). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1884-1891(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2113-2120 (Oct 1970).

The microwave apparatus was used to measure the lifetime of the 269-keV state of ^{219}Rn and the 350-keV state of ^{207}Tl. The conversion-electron spectrum in coincidence with alpha particles is shown. Partial lifetimes and hindrance factors for gamma transitions are also found. (JFP)

19100 FINE STRUCTURE RESONANCES IN THE ELASTIC SCATTERING OF NEUTRONS BY NEARLY MAGIC NUCLEI. Kolomiets, V. M. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1947-1952(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2183-2187 (Oct 1970).

The excitation of subgiant resonances and fine structure resonances in the elastic scattering of neutrons by even-even nuclei below the threshold for inelastic scattering is considered, and a sum rule found. The elastic scattering of neutrons by lead-206 and -208 is considered. The properties of resonances due to the excitation of the proton shell of the target nucleus are discussed. (JFP)

19101 MICROSCOPIC DESCRIPTION OF THE LOW-LYING POSITIVE PARITY STATES OF THALLIUM. Tomaselli, M.; Herold, D.; Broo, D. (Technische Univ. Darmstadt (F. R. Germany). Inst. fuer Kernphysik); Gruenbaum, L. (Kernforschungszentrum Karlsruhe (F. R. Germany)). Phys. Lett., B; 58: No. 4, 395-396(29 Sep 1975).

The electromagnetic properties of the low-lying positive-parity states of ^{205}Tl together with the hyperfine splittings in muonic thallium have been calculated using nucleon shell model wave functions with configuration mixing. (NL)

19102 PHOTOFISSION IN BISMUTH AT INTERMEDIATE ENERGY. Areskoug, M.; Schroeder, B.; Lindgren, K. (Lund Univ. (Sweden). Fysiska Institutionen). Nucl. Phys., A; 251: No. 3, 418-432(27 Oct 1975).

The yields of 43 fission products from photofission in ^{209}Bi induced by 600 MeV bremsstrahlung have been measured. From these values the mass and charge distributions have been determined. The peak position of the mass distribution is at A_p = 96.3 ± 0.5 a.m.u. and the FWHM is 34.8 ± 0.7 a.m.u. The ranges of 15 fission products have been determined using the thick-target thick-catcher technique, and the kinetic energies have been deduced. Experimental results are compared with cascade-evaporation calculations in combination with liquid-drop-model calculations for the fission process. (NL)

19103 DELBRUECK SCATTERING OF 2.75 MeV PHOTONS BY LEAD. Schumacher, M.; Borchert, I.; Smend, F.; Rullhusen, P. (Goettingen Univ. (F. R. Germany). 2. Physikalisches Inst.). Phys. Lett., B; 59: No. 2, 134-136(27 Oct 1975).

The differential cross section for the elastic scattering of photons was measured for Pb at $\theta = 120°$ and E = 2.75 MeV; the measurement yielded $d\sigma/d\Omega = 34.7 \pm 1.6$ μb/sr in agreement with $d\sigma/d\Omega = 32.2$ μb/sr calculated using the Delbrueck amplitudes of

Papatzacos and Mork. Definite evidence for the real part of the Delbrueck amplitude has been obtained for the first time. (NL)

19104 HEAVY ION ELASTIC SCATTERING SURVEY. I. ^{208}Pb Target. Ball, J. B.; Fulmer, C. B.; Gross, E. E.; Halbert, M. L.; Hensley, D. C.; Ludemann, C. A.; Saltmarsh, M. J.; Satchler, G. R. (Oak Ridge National Lab., Tenn. (USA)). Nucl. Phys., A; 252: No. 1, 208-236(3 Nov 1975).

Differential cross sections for elastic scattering of ^{12}C ions of 96 MeV, ^{16}O ions of 129.5 and 192 MeV, and ^{20}Ne ions of 161.2 MeV from ^{208}Pb were measured and analyzed using the optical model. Values of the real potential near the strong absorption radii were extracted and some constraints put on its slope. Some information on the slope of the imaginary potential in this region was also obtained, while the magnitude of the imaginary potential here was found to be comparable to that for the real potential. The scattering was found to be almost completely insensitive to the real or imaginary potential for center-of-mass separations less than approximately 10 fm. In addition to Woods-Saxon potentials, folded-model potentials were also used, and a consistent description of the present and other data was obtained with a Gaussian nucleon-nucleon interaction. It was found that a nucleon-nucleon interaction with a range as long as that for one-pion-exchange is unacceptable. (NL)

19105 EVIDENCE FOR GIANT *M2* STATES IN ^{208}Pb. Lindgren, R.A.; Bendel, W.L.; Fagg, L.W.; Jones, E.C. Jr. (Naval Research Laboratory, Washington, D.C. 20375). Phys. Rev. Lett. 35: No. 21, 1423-1425 (24 Nov 1975).

Transitions to states in ^{208}Pb at 7.40 and 7.91 MeV excitation are suggested to be components of a giant magnetic quadrupole resonance in ^{208}Pb. (auth)

19106 FINITE-RANGE CALCULATION FOR THE TWO-STEP REACTION ^{208}Pb$(p, d)^{207}$Pb$(d, t)^{206}$Pb(3+). Charlton, L.A. (Department of Physics, The Florida State University, Tallahassee, Florida 32306). Phys. Rev. Lett. 35: No. 22, 1495-1497 (1 Dec 1975).

An exact finite-range calculation of the differential cross section has been performed for the two-step process ^{208}Pb$(p,d)^{207}(d,t)$ ^{206}Pb(3+). It is found that finite-range theory differs from the conventional zero-range results by 20 to 40%, depending on the scattering angle. (auth)

19107 NUCLEAR RESONANCE FLUORESCENCE IN $^{206\ 207\ 208}$Pb AND ^{209}Bi. Coope, D. F. Urbana, IL; Univ. of Illinois (1975). 90p. University Microfilms Order No. 75-24,286.

Thesis (Ph. D.).

^{208}Pb has both neutron and proton closed shells and is known to be as ideal a nucleus in terms of the shell model as exists. Knowledge of those states in ^{208}Pb and neighboring nuclei that can be excited by radiation is of general value in furthering our understanding of nuclear structure. Nuclear resonant photon scattering between 4 MeV and the neutron separation energy for targets of $^{206\ 207\ 208}$Pb and ^{209}Bi was observed with a large Ge(Li) detector. Energies and ground state decay widths were measured for twenty-six newly identified levels. An understanding of some of these levels in terms of a particle-core weak-coupling model is suggested. (Diss. Abstr. Int., B)

Nuclear Properties and Reactions, A ≥ 220

Refer also to abstracts 17599, 17600–17603, 18934, 18983, 19043, 19056, 19098, 19187, 19190, and 19224.

19108 (BNL-NCS-50446, pp 192-206) ^{232}Th CROSS SECTION EVALUATION FOR ENDF/B-IV. Wittkopf, W. A. Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N. Y. (USA)).

The cross sections for neutron capture and fission of ^{232}Th have been evaluated for ENDF/B-IV. (SDF)

19109 (BNL-NCS-50446, pp 207-285) NEUTRON CROSS SECTION TABULATED DATA. Apr 1975.

In ENDF/B-IV dosimetry file. (Brookhaven National Lab., Upton, N. Y. (USA)).

Evaluations of cross sections for the reactions ^{235}U(n,f), ^{238}U(n,f), ^{238}U(n,gamma), ^{237}Np(n,f), and ^{239}Pu(n,f) are given. (SDF)

19110 (CEN-BG-7506) STUDY OF ^{232}Pa FISSION INDUCED BY FAST NEUTRONS. Caitucoli, F. (Bordeaux-1 Univ., 33-Gradignan (France). Centre d'Etudes Nucleaires; Bordeaux-1 Univ., 33 (France)). 1975. 77p. (In French). INIS.

The ^{231}Pa(n,f) reaction excitation function has been measured from 150 keV to 1300 keV with 12 keV energy resolution and shows two resonances around 200 keV and 330 keV. The neutrons are produced by the ^{7}Li(p,n) reaction and the fission fragments are recorded in "Makrofol" plastic foils. The cross section is obtained by comparison with ^{235}U(n,f) and ^{238}U(n,f) cross section. Fission barrier parameters are deduced from the analysis of the excitation function with a statistical model which takes into account the competition between the different decay channels (γ, neutron fission) and assuming a complete damping in the two wells. The first barrier is higher than predicted which confirms the "thorium anomaly". Fission fragments angular distribution have been measured in the vicinity of the resonances. The two resonances (shape of the resonance and angular distribution) have been analysed using a few fission channels without any damping in the second well; this analysis shows that each resonance may be interpreted as the superposition of two pure vibrational resonances. (FR)

19111 (ORO-4856-26, pp 358-359) GAMMA-RAY PRODUCTION CROSS-SECTIONS FROM THE INTERACTION OF 140 MeV alpha-PARTICLES WITH ^{232}Th. Hornyak, W. F.; Chang, C. C.; Walters, W. B.; Holmgren, H. D. (Univ. of Maryland, College Park). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

In a preliminary experiment using a metallic ^{232}Th target bombarded with 140 MeV alpha-particles, some gamma-rays were tentatively identified, in an observed array of well over 200 lines, originating in residual nuclides corresponding to near-symmetric fission and the population of the principal Th-decay chain elements. Time gated spectra were observed in the manner described in the paper on Al + alpha, Part I, to permit assigning both "prompt" and "delayed" yields. Severe background problems and the high multiplicity of observed lines render most of the presently quoted assignments tentative. (auth)

19112 (ORO-4856-26, pp 591-592) MASS AND KINETIC ENERGY DISTRIBUTIONS IN MeV NEUTRON INDUCED FISSION OF ^{232}Th, ^{235}U AND ^{238}U. Holubarsch, W.; Goennenwein, F. (Univ., Tuebingen, Ger.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19113 (ORO-4856-26, pp 593-594) ANOMALIES IN THE FISSION OF FERMIUM. Goennenwein, F.; Schultheis, H.; Schultheis, R.; Wildermuth, K. (Univ., Tuebingen, Ger.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

An analysis on the basis of cluster representations shows that the observed anomalies in the fission of Fermium are due to substructure effects. (auth)

19114 PHOTO-FISSION IN ^{232}Th AND ^{238}U USING A VARIABLE ENERGY SOURCE OF γ RADIATION. Knowles, J. W.; Khan, A. M.; Cross, W. G. (Chalk River Nuclear Labs., Ont.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1445-1452(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1627-1634(Aug 1970).

Photofission cross sections and angular distributions are measured for thorium-232 and uranium-238. (JFP)

19115 NEW RESULTS ON THE DECAY OF ^{225}Ac. Dzhelepov, B. S.; Zolotavin, A. V.; Ivanov, R. B.; Mikhailova, M. A.; Sergeev, V. O.; Sovtsov, M. I. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1897-1900(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2127-2130 (Oct 1970).

The $\pi\sqrt{2}$ magnetic β spectrometer was used in a continuation of the study of ^{225}Ac → ^{221}Fr decay. The conversion electron spectra and transition multipolarities and intensities for ^{221}Fr are discussed. (JFP)

19116 LOW-SPIN LEVELS OF ^{234}U POPULATED IN THE DECAY OF ^{234m}Pa(UX_2). Ardisson, G.; Marsol, C. (Institut d'Etudes Nucleaires, Algiers). Nuovo Cim.; 28A: No. 2, 155-172 (21 Jul 1975). (In French)

Radioactive decay of ^{234}Pa$^{m}(UX_2)$ has been reinvestigated by means of different-size coaxial Ge(Li) detectors. γ-γ coincidences were performed with a Ge(Li)-NaI(Tl) assembly. More than one

hundred γ-rays were measured in this study, of which seventy were new. A ^{234}U level scheme is proposed which interprets most γ-rays. New levels were found at 1174.2, 1457.5, 1501.1, 1667.4, 1694.0, 1796.0, 1863.8, and 1970.0 keV. Known levels at 849.6 keV ($KJ^{\pi} = 03^{-}$), 926.8 keV ($KJ^{\pi} = 22^{+}$), 989.8 keV ($KJ^{\pi} = 22^{-}$), 1085.7 keV ($KJ^{\pi} = 02^{+}$), 1125.7 keV ($KJ^{\pi} = 22^{+}$) and 1601.9 keV ($J^{\pi} = 1^{+}$) were also found in this decay. (auth)

19117 EVALUATION OF THE (n, 2n) AND (n, 3n) REACTIONS FOR ^{239}Pu. Sukhovitskii, E. Sh.; Kon'shin, V. A. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 3, 23-27(1974). (In Russian)

A nuclear model for calculation of the (n, 2n) and (n, 3n) neutron cross sections is proposed. The model uses experimental data on the process of neutron interaction with nuclei. The (n, 2n) and (n, 3n) cross sections for both U-238 and Pu-239 are calculated and the results are compared with those of other evaluations. (2 figures, 1 table) (auth)

19118 NUCLEAR DATA FOR ^{239}Pu IN THE FORBIDDEN RESONANCE REGION OF NEUTRON ENERGIES. Antsipov, G. V.; Benderskii, A. R.; Kon'shin, V. A.; Sukhovitskii, E. Sh. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 3, 17-22(1974). (In Russian)

The average resonance parameters for Pu-239 in unresolved resonance energy region are obtained both from parameters in the resolved resonance energy region and fitting the experimental data for neutron cross sections. The average resonance parameters obtained allowed calculation of the α-value for Pu-239 with a satisfactory accuracy. (3 figures, 2 tables) (auth)

19119 EVALUATION OF THE CROSS SECTIONS OF NUCLEAR REACTIONS FOR ^{239}Pu IN THE RESONANCE ENERGY REGION DURING PROCESSING OF A COMPLETE FILE OF CONSTANTS. Kon'shin, V. A.; Morogovskii, G. B.; Sukhovitskii, E. Sh. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 2, 21-28(1974). (In Russian)

All the available experimental data for σ_f, σ_t and σ_ε of Pu-239 in the resolved energy region were analysed for obtaining the resonance parameters. The resonance parameters were obtained by simultaneous fitting of the data for σ_f, σ_t and σ_ε. The comparison of the average cross sections calculated with resonance parameters obtained shows a satisfactory agreement with the experimental data. The values of average resonance parameters are given. (auth)

19120 MEASUREMENT OF α-VALUES FOR ^{235}U IN FILTERED BEAMS OF REACTOR NEUTRONS AT THE OBNINSK ATOMIC POWER STATION. Drukhsherstnov, V. G.; Kazanskii, Yu. A.; Furmanov, V. M.; Petrov, V. L. At. Energ. (USSR); 39: No. 2, 86-89(Aug 1975). (In Russian).

Alpha values for ^{235}U have been measured in filtered beams of neutrons of energy: 2.0, 24.5, 140 keV and the soft neutron spectrum. The $\bar{\alpha}$-values obtained are compared with data of differential measurements and calculations based on various systems of constants. (4 figures, 3 tables, 36 references.) (auth)

19121 SMALL-ANGLE SCATTERING OF 7-14-MeV NEUTRONS BY Pb AND U. Bucher, W.P.; Hollandsworth, C.E. (U. S. Army Ballistic Research Laboratories, Aberdeen Proving Ground, Maryland 21005). Phys. Rev. Lett. 35: No. 21, 1419-1422 (24 Nov 1975).

Absolute cross sections for neutrons elastically scattered through small angles by Pb and U have been accurately measured at various energies in the range 7-14 MeV. The results disagree with many previously reported measurements and especially their interpretations regarding anomalous scattering. However, optical-model predictions based on the energy-independent, nonlocal potential of Perey and Buck are, apart from normalization, in agreement with the present measurements for Pb. (auth)

19122 ANGULAR CORRELATION OF NEUTRONS FROM SPONTANEOUS FISSION OF ^{252}Cf. Pringle, J.S.; Brooks, F.D. (Physics Department, University of Cape Town, Rondebosch, 7700, South Africa). Phys. Rev. Lett. 35: No. 23, 1563-1566 (8 Dec 1975).

The *n-n* angular correlation for neutrons emitted in spontaneous fission of ^{252}Cf has been measured. Discrepancies are observed when these and other experimental observations are compared with Monte Carlo calculations based on the evaporation model. It is suggested that the discrepancies could be attributed to enhanced neutron emission along the fission axis. (auth)

19123 MEASUREMENT OF PRE- AND POST-FISSION NEUTRON EMISSION AT MODERATE EXCITATION ENERGIES. Fraenkel, Z. (Argonne National Laboratory, Argonne, Illinois 60439 and Weizmann Institute of Science, Rehovot, Israel); Mayk, I.; Unik, J.P.; Gorski, A.J.; Loveland, W.D. Phys. Rev. C 12: No. 6, 1809-1825 (Dec 1975).

Fission fragment mass-energy distributions and the coincident neutron velocity distributions have been measured at 0° and 90° with respect to the fragment direction. The fissioning systems studied were ^{209}Bi, ^{232}Th, ^{233}U, ^{238}U, and ^{239}Pu bombarded with 45 MeV α particles and ^{226}Ra bombarded with 16 MeV protons. From the above measured quantities the number of pre-fission neutrons and the number of post-fission neutrons were obtained as a function of fragment mass and total fragment kinetic energy. The average number of pre-fission neutrons emitted is 2.9±0.9 for the ^{232}Th target, 3.3±1.5 for ^{233}U, 3.6±1.6 for ^{238}U, and 2.7±0.8 for ^{239}Pu. The average number of post-fission neutrons emitted by these systems is 4.4±0.3, 4.2±0.7, 4.6±0.7, and 5.1±0.3, respectively. (The values reported for pre-fission neutrons include also contributions from scission neutrons.) The number of pre-fission neutrons from the ^{226}Ra+16 MeV proton system is 0.5±0.3. The number of post-fission neutrons is 3.6±0.4. The number of neutrons emitted from the ^{209}Bi+45 MeV α particle system is 3.6±0.2. The number of post-fission neutrons as a function of fragment mass and total kinetic energy which were obtained by the direct neutron measurements of this work are lower and are more consistent with calculated total energy balances than the values obtained by the indirect method based on the simultaneous measurement of both the kinetic energy and the velocity of the fission fragments. Our results for the average number of pre-fission neutrons are compared with calculations based on the conventional expression for Γ_f/Γ_n. The agreement between the calculated results and our experimental results is satisfactory. However, the calculations predict spallation cross sections which are much larger than those obtained experimentally by radiochemical methods. (auth)

19124 RECOIL PROPERTIES OF ^{232}Th(γ, *xn*) EVAPORATION PRODUCTS. Jungclas, H.; Brandt, R.; Stark, G. (Kernchemie, Fachbereich 14, Philipps-Universität Marburg (Lahn), D-355 Marburg, Germany). Phys. Rev. C 12: No. 6, 1834-1843 (Dec 1975).

Photonuclear recoil studies with thick ThF_4 targets and thick catcher foils for the emitted products after neutron evaporation were carried out with bremsstrahlung of a 55 MeV electron beam. The hypothetical range (R_0) of the ^{232}Th(γ, *xn*)$^{232-x}$Th reaction recoils ($x = 5,6$) in the target material was found to be about 12 μg/cm² (in the frame of the moving compound nucleus). The effective ranges in beam and in the opposite direction (R_+ and R_-) lead to forward-backward recoil ratios (R_+/R_-) of 2–4, increasing with the number of evaporated neutrons ($x = 4,5,6$). The reaction kinematics are discussed in the compound nucleus model, first by a step-by-step Monte Carlo calculation, then by a mean value analysis. The calculated mean ranges and forward-backward recoil ratios agree satisfactorily with the experimental results for most residual nuclei studied. (auth)

19125 PARAMETERS OF THE SUBTHRESHOLD FISSION STRUCTURE IN ^{240}Pu. Auchampaugh, G.F. (Los Alamos Scientific Laboratory, Los Alamos, New Mexico 87545); Weston, L.W. Phys. Rev. C 12: No. 6, 1850-1857 (Dec 1975).

The neutron subthreshold fission cross section of ^{240}Pu has been measured from 500 to 10 000 eV using the Oak Ridge electron linear accelerator neutron facility. A total of 82 fission widths were obtained from area and shape analysis of those resonances which define the class II states at $\simeq$ 782, $\simeq$ 1405, $\simeq$ 1936, and $\simeq$ 2700 eV. The average square of the coupling matrix element for the first three class II states is 1.85 ± 1.43 eV² [standard deviation (SD)]. The average class II fission width is 2.5 ± 1.0 eV (SD). Approximately 22 clusters of class I resonances were observed below 10 keV, which results in a value of 450 ± 50 eV for the average class II level spacing. Assuming parabolic inner and outer barriers, the following barrier parameters were obtained: $V_A - B_n/\hbar\omega_A = 0.71^{+0.21}_{-0.09}$ and $V_B - B_n/\hbar\omega_B = 0.53^{+0.09}_{-0.06}$. (auth)

19126 LIFETIMES OF ROTATIONAL STATES IN ^{232}Th. Johnson, N.R.; Sturm, R.J.; Eichler, E.; Guidry, M.W.; O'Kelley, G.D.; Sayer, R.O.; Hensley, D.C. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830); Singhal, N.C.; Hamilton, J.H. Phys. Rev. C 12: No. 6, 1927-1936 (Dec 1975).

Lifetimes of the 4⁺ through 10⁺ member of the ground-state rotational band in ^{232}Th have been measured by the Doppler-shift recoil-distance technique. These states were Coulomb excited by 152-MeV ^{40}Ar ions, and measurements were carried out in coincidence with the backscattered projectiles. The half-lives for the 4⁺ through 10⁺ states are 164 ± 13, 66.2 ± 5.1, 25.1 ± 2.3, and 11.2 ± 1.7 ps, respectively. The B ($E2$) values deduced for these states are systematically about 10% smaller than rigid-rotor values; however, the constancy of the transition quadrupole moments is interpreted as an indication of rotational behavior. (auth)

19127 SIGN OF THE $E4$ MOMENT IN ^{236}U BY MULTIPLE COULOMB EXCITATION WITH ^{40}Ar IONS. Guidry, M.W.; Eichler, E; Johnson, N.R.; O'Kelly, G.D.; Sturm, R.J.; Sayer, R.O. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830). Phys. Rev. C 12: No. 6, 1937-1944 (Dec 1975).

Multiple Coulomb excitation with ^{40}Ar projectiles has been used to excite the ground state rotational band of ^{236}U through the 12⁺ state.

A comparison of the experimental and theoretical excitation probabilities confirms a positive value for the E4 moment, removing the sign ambiguity inherent in the determination of this moment by α-particle Coulomb excitation. (auth)

19128 POSSIBLE EVIDENCE FOR SUPERHEAVY NUCLEI FROM SPONTANEOUS TERNARY FISSION RATES. Schultheis, H.; Schultheis, R. (Tuebingen Univ. (F. R. Germany). Inst. fuer Theoretische Physik). Phys. Lett., B; 58: No. 4, 384-386(29 Sep 1975).

Calculated ternary (T) fission barriers are found to exceed the binary (B) barriers by only 10% for the most stable superheavy nuclei. The predicted exceptionally high relative rate ($\gamma_T/\gamma_B \simeq 1\%$) for spontaneous fission should enable an experimental test for superheavy nuclei in a given sample. (NL)

19129 ANALYSIS AND COMPARISON OF PLUTONIUM-238 NUCLEAR DATA. Caner, M.; Yiftah, S. (Soreq Nuclear Research Centre, Yavne, Israel). Nucl. Sci. Eng.; 59: No. 1, 46-50 (Jan 1976).

A new evaluation of basic neutron data for ^{238}Pu has been performed. In the present report the resolved resonance parameters, the radiative capture, and the fission cross sections, as well as the average number of neutrons per fission, are discussed. A comparison is made with the corresponding ENDF/B-IV file. 5 figures. (auth)

19130 SLOW-NEUTRON FISSION CROSS SECTIONS OF THE COMMON FISSILE NUCLIDES. (Revised 1975). Bigham, C. B. (Chalk River Nuclear Labs., Ont.). Nucl. Sci. Eng.; 59: No. 1, 50-52(Jan 1976).

The fission cross sections for ^{233}U, ^{235}U, ^{239}Pu, and ^{241}Pu reported in 1958 have been revised using the very precise recently published, specific activities 21,405 +- 20 dpm/mu g ^{233}U, 4798.1 +- 3.3 dpm/mg ^{235}U, and 746.19 +- 0.41 dpm/mg ^{253}U. Revised ratios of fission cross sections at 2200 m/sec are: $^{233}U/^{235}U$ equals 0.9142 +- 0.0012, $^{239}Pu/^{235}U$ equals 1.2876 +- 0.0034, $^{239}Pu/^{233}U$ equals 1.4084 +- 0.0036, and $^{241}Pu/^{239}Pu$ equals 1.3506 +- 0.007. Revised fission cross sections at 2200 m/sec in barns relative to sigma/sub c/(^{197}Au) equals 98.7 +- 0.2 are: sigma/sub f/(^{233}U) equals 527.4 +- 3.1, sigma/sub f/(^{235}U) equals 576.9 +- 3.4, sigma/sub f/(^{239}Pu) equals 742.8 +- 4.4, and sigma/sub f/(^{241}Pu) equals 1003.3 +- 5.2. The errors do not include g-factor errors of +-0.2 percent for ^{233}U, +-0.155 percent for ^{235}U, +-0.285 percent for ^{239}Pu, and +-0.7 percent for ^{241}Pu. (auth)

19131 TRANSACTINIDE ELEMENTS. Hemingway, J. D. (Universities Research Reactor, Risley, Eng.). Radiochemistry (London); 2: 128-174(1975).

The review is covered in sections, entitled: predicted nuclear properties — including closed shells, decay characteristics; predicted chemical properties — including electronic structure and calculated properties, X-radiation, extrapolated chemical properties, separation chemistry; methods of synthesis; the natural occurrence of superheavy elements. (UK)

Nuclear Theory

Refer also to abstracts 17411, 18534, 18692, 18695, 18798, 19113, and 19160.

19132 (CEA-CR-2, pp 1-26) ELECTRON SCATTERING AND NUCLEAR STRUCTURE. Analysis as a Function of the Momentum Transferred to the Nucleus. Soyeur, M. [nd]. (In French)

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8–10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The basic concepts and hypotheses used for describing electron-nucleus scattering are reviewed together with the nuclear information drawn from scattering cross sections. (FR)

19133 (CEA-CR-2, pp 27-39) WHAT CAN BE LEARNED FROM PROTON INELASTIC SCATTERING. Layly, V. [nd]. (In French)

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8–10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

It is shown that proton inelastic scattering by nuclei is a good tool to obtain information on: the ρ_{LSJ} transition density for given L and S, ρ_{LSJ} transition densities corresponding to L of abnormal parities, the difference between proton and neutron densities, transition densities with spin-flip when the transition is also possible via the S = 0 component. It is also possible to study densities corresponding to high momentum transfer and pion physics. (FR)

19134 (CEA-CR-2, pp 40-55) WHY HIGH MOMENTA. Sick, I. [nd]. (In French)

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8–10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The interest of the information obtained by studying electron elastic scattering at high momentum transfer is underlined. (FR)

19135 (CEA-CR-2, pp 81-91) MEASUREMENT OF MOMENTUM DISTRIBUTIONS USING (e,e'p) REACTIONS. Mougey, J. [nd]. (In French)

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8–10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The problems arising when the (e,e'p) reaction is used to measure proton momentum distribution in nuclei are reviewed. The results obtained at the Saclay linear accelerator laboratory are discussed. (FR)

19136 (CEA-CR-2, pp 92-100) HIGH MOMENTUM ASPECTS IN ELASTIC ELECTRON SCATTERING. Knoll, J. [nd].

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8–10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The problem of how information might be hidden by distorsion and dispersive effects is discussed. Dispersive corrections are reviewed. Then a brief collection of properties of the amplitude in Born approximation is made. The influence of Coulomb correction is discussed using an asymptotic expansion of the DWBA amplitude. (FR)

19137 (CEA-CR-2, pp 101-122) BEHAVIOR OF CHARGE DENSITIES CALCULATED WITH SELF-CONSISTENT METHODS AT HIGH TRANSFER MOMENTUM. Campi, X. [nd]. (In French)

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8–10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

Self-consistent methods only, among methods having a theoretical basis, give a possibility to calculate the charge density of any nucleus of the periodic system. However these calculations cannot quantitatively account for the results on electron elastic scattering at high transfer momentum. (FR)

19138 (CEA-CR-2, pp 133-144) PROTON-NUCLEUS ELASTIC SCATTERING AT INTERMEDIATE ENERGIES. Lombard, R. J. [nd]. (In French)

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8–10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The study of proton-nucleus scattering in the GeV energy range is presented from the point of view of the nuclear structure. The results were obtained by applying multiple scattering theory to Glauber approximation. (FR)

19139 (CEA-CR-2, pp 145-157) MICROSCOPIC CALCULATION OF HIGH ENERGY PROTON SCATTERING. Gustafsson, C [nd]. (In French)

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8–10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91–Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

Proton-nucleus inelastic scattering was studied in the framework of KMT formalism, taking into account the complete nucleon-nucleon interaction and using a microscopic description of nuclear states. (FR)

19140 (CEA-CR-2, pp 159-170) NUCLEAR STRUCTURE EFFECTS AT HIGH ENERGIES. Rost, E. [nd].

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8-10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The simplest nuclear transfer reaction, i.e., the (p,d) reaction exciting discrete states in the residual nucleus, is discussed. A simple analysis of the experimental data obtained with ^{12}C and ^{40}Ca targets was made using DWBA. (FR)

19141 (CEA-CR-2, pp 179-188) EFFECTS OF SHORT RANGE CORRELATIONS IN HADRON-NUCLEUS ELASTIC SCATTERING. Lambert, E. [nd]. (In French)

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8-10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

Some aspects of the analysis of nuclear correlation effects in hadron-nucleus elastic scattering are recalled. The quality of the information on correlations obtained in such an analysis is discussed. (FR)

19142 (CEA-CR-2, pp 189-205) CURRENT RESEARCH ON N*'s IN NUCLEI. Kisslinger, L. S. [nd].

From colloquium on measurement and interpretation of high momenta in nuclei; Saclay, France (8 May 1974).

In measurement and interpretation of high momenta in nuclei. Saclay, France, 8-10 May 1974. Proceedings. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire).

The research in progress on the effect of baryon resonance (N*) components of nuclei, and in particular the high momentum components of nuclei is discussed. (FR)

19143 (CEA-N-1805) CONTRIBUTION TO THE STUDY OF THE NEUTRON STRENGTH FUNCTIONS AND OF THE OPTICAL MODEL AT VERY LOW ENERGY. Delaroche, J. P. (CEA Centre d'Etudes Nucleaires de Saclay, 91-Gif-sur-Yvette (France). Dept. de Physique Nucleaire; Paris-11 Univ., 91-Orsay (France)). Jun 1975. 106p. (In French). INIS.

In the low energy range, evidence for neutron absorption variations versus the A mass target number may be obtained from the determination of s and p wave neutron strength functions $S_0(A)$ and $S_1(A)$ which are simple connected to s and p wave components of the compound nucleus cross-sections. Some works have been done as an attempt to explain S_0 and S_1 variations in terms of optical potential calculations. Though coupled channel calculations were shown to be better than spherical calculations, the trend of variations was obtained, without any general satisfactory fits. In addition, it was not usually possible to produce a simultaneous agreement between measured and calculated values of $S_0(A)$ and $S_1(A)$ so that one may suspect the validity of optical model interpretation in the low energy region. In the present work, this study is continued with an improved version of the Tamura coupled channel code JUPITOR-1. So many experimental results, some of which obtained at Saclay's 60 MeV LINAC, were interpreted in a satisfactory way: S_0 and S_1 and, for odd mass nucleus, possible variations with spin of compound nucleus. That was possible by including, in optical potential, a complex isospin-isospin term, and a real spin-spin term as suggested by Feshbach. For a given nucleus, it was shown that it is possible to have a simultaneous fit for S_0 and S_1, using only one set of optical potential parameters. Results, such obtained from these calculations, suggest that neutron-nucleus optical potential parametrisation might be similar in the low and in higher energy range. (FR)

19144 (IPNO/TH-75-8) PROPERTIES OF AN EQUATION WITH A NEGATIVE COLLECTIVE MASS. Cugnon, J. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). Apr 1975. 11p. Dep. NTIS (US Sales Only) $3.50.

The properties of a Schrödinger equation involving a variable collective mass, which can be negative, are investigated within a simple model. In particular, it is shown that such an equation can yield a ground state below the minimum of the potential. (auth)

19145 (IPNO/TH-75-13) PROPERTIES OF HEAVY ION INTERACTION POTENTIALS CALCULATED IN THE ENERGY DENSITY FORMALISM. Ngo, C.; Tamain, B.; Beiner, M.; Lombard, R. J.; Mas, D.; Deubler, H. H. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). Apr 1975. 32p. Dep. NTIS (US Sales Only) $4.00.

Properties of the real part of the interaction potential between two colliding ions are studied. The calculations are performed in the framework of the energy density formalism, using the sudden approximation. In particular, it is shown that the potential can be written as the product of a "universal" function and of a geometrical factor. The universal function itself can be parametrized in a simple way. Connections with the proximity theorem of Randrup, Swiatecki and Tsang are discussed in detail. Comparisons with other available potentials are made on a typical example. (9 figures, 2 tables) (auth)

19146 (IPNO/TH-75-17) OPTICAL POTENTIAL FOR LOW-ENERGY NEUTRONS IMAGINARY POTENTIAL FOR NEUTRON-^{40}Ca ELASTIC SCATTERING. Vinh Mau, N.; Bouyssy, A. (Paris-11 Univ., 91-Orsay (France). Inst. de Physique Nucleaire). May 1975. 52p. Dep. NTIS (US Sales Only) $4.50.

A derivation of the optical potential from the Green's functions formalism is achieved including RPA correlations. The imaginary parts of the non local and equivalent local optical potentials are calculated for low energy neutron scattering on ^{40}Ca, using a zero-range effective nucleon-nucleon interaction. The potential is expressed as a sum of a surface and a volume terms, the parameters of which are in qualitative agreement with phenomenological values. (26 figures, 46 references) (auth)

19147 (IPNO-TH-75-22) COLLECTIVE PAIRING STATES AND NONUNITARY REPRESENTATIONS OF THE QUASI-SPIN GROUP. Lorazo, B. (Paris-11 Univ., 91-Orsay (France). Div. de Physique Theorique). Jun 1975. 8p. INIS.

A mathematical proof is given of the intimate connection of the physical generalized seniority states (i.e., states the excitation energy spectra of which does not depend upon the number of particles) with states transforming according to nonunitary representations of the quasi-spin group. (FR)

19148 (JUL-1217) TABLES OF THE 3-j, 6-j, F_k-, A_k-, R_k-, AND A_{kk}- COEFFICIENTS FOR ANGULAR CORRELATION MEASUREMENTS INVOLVING HALF INTEGER SPINS UP TO $15/2$ AND TRANSITIONS UP TO L = 3. Gueven, H. H.; Kardon, B.; Seyfarth, H. (Kernforschungsanlage Juelich G.m.b.H. (F. R Germany). Inst. fuer Kernphysik). Jul 1975. 259p. Dep. NTIS (US Sales Only) $9.00.

In addition to the excitation energies of nuclear levels knowledge about their spins and the multipole character of the electromagnetic transitions occuring between these states is of great importance for detailed nuclear structure studies and comparisons with nuclear models. This information can be directly obtained through the observation of the angular distribution and the directional correlation of the nuclear radiation fields emitted during the depopulation of the levels. Extensive tabulations of theoretical angular correlation coefficients needed for analysis of cascade data are presented. (3 tables) (auth)

19149 (LYCEN-7501) ANNUAL REPORT 1974. (Lyon-1 Univ., 69-Villeurbanne (France). Inst. de Physique Nucleaire). 1975. 50p. (In French). INIS.

This annual report supersedes the work done in the nuclear physics institute at Lyon. The studied matters are the following: nuclear theory, nuclear reactions, nuclear spectroscopy and nuclear chemistry. (FR)

19150 (ORO-4856-26) CLUSTERING PHENOMENA IN NUCLEI: II. Invited Lectures and Contributed Papers from the Second International Conference on Clustering Phenomena in Nuclei, College Park, Maryland, 21-25 April 1975. Goldberg, D. A.; Marion, J. B.; Wallace, S. J. (Eds.). (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy). 1975. 651p. (CONF-750447-). Dep. NTIS $13.60.

Invited lectures and contributed papers on clustering phenomena are presented. Topics include general aspects of clustering phenomena, reaction theory, light nuclei, elastic and quasi-elastic scattering, exotic and energetic reactions, multinucleon transfer and cluster spectroscopy, molecular states, and fission, fusion, and alpha decay. Separate abstracts are prepared for the 128 items included in these proceedings. (BJG)

For abstracts of individual papers see: 18771-18783, 18807-18854, 18901-18914, 18945-18947, 18986, 19018-19022, 19095, 19111-19113, and 19151-19190.

19151 (ORO-4856-26, pp 3-22) SURVEY OF INTRINSIC STATES OF LIGHT NUCLEI. Brink, D. M. (Univ. of British Columbia, Vancouver, Can.). 1975.

From second international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The resonating group method and the generator coordinate method are two closely related theories of nuclear structure which

can be used to construct wave functions describing cluster structures. In both cases the form of the intrinsic state implies a selection of those degrees of freedom which are regarded as being important for the problem under consideration. The form of the intrinsic state also corresponds to a particular truncation of the shell model space. In the resonating group method the effect of the Pauli principle leads to forbidden or redundant states of relative motion of clusters. An improved understanding of the role of forbidden states in the theory has led to important advances in the phenomenological description of cluster structures in nuclei. 3 tables, 2 figures (auth)

19152 (ORO-4856-26, pp 23-37) SURVEY OF SHELL MODEL TWO AND FOUR NUCLEON CORRELATIONS. Gillet, V. (CEN, Saclay, France). 1975.

From second international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Shell model strong and weak bonds in nuclei are discussed. This problem concerns in particular the recent fragmentation experiments of medium and heavy nuclei. They are induced by the scattering of high energy projectiles (p,pi,alpha...) or the atomic capture of pions or kaons. Nucleons in space symmetric states have greatly enhanced interactions because of the exchange and short range nature of nuclear forces. This fact leads not only to cluster models in light nuclei but also to specific 2 and 4 nucleon substructures in the shell model of medium and heavy nuclei. These correlations are approached by examining the following two points: 1. Strong and weak bonds between core nucleons described by a spherical j-j coupling Hartree-Fock state. 2. Strong and weak bonds between valence nucleons as shown by (a) the fine structure of the mass curve; (b) shell model configuration mixing calculations; (c) aligned or pairing schemes. Core and valence nucleons must be distinguished because in the latter case the pairing and alignment effects of nuclear forces can fully play in paired or aligned structures. The way these effects yield stable sub-structures in closed j shells require a special treatment. It is convenient to define as a "quartet" any group of two protons and two neutrons whose mutual interactions are much stronger than their interactions with the remaining nucleons of the system, whatever their space correlation or relative quantum numbers. (auth)

19153 (ORO-4856-26, pp 38-55) SURFACE CLUSTERING. Arima, A. (Tokyo Univ.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

A shell model cluster and a localized cluster are defined. Enhancement of clustering at the nuclear surface is predicted by extended shell model calculations and cluster model calculations. Experimental evidence of the surface clustering is shown. Many-particle, many-hole excitations are discussed in connection with the surface clustering. 8 tables, 7 figures, 45 references. (auth)

19154 (ORO-4856-26, pp 56-65) SYMMETRIES OF CLUSTER CONFIGURATIONS. Kramer, P. (Univ., Tuebingen, Ger.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

A deeper understanding of clustering phenomena in nuclei must encompass at least two interrelated aspects of the subject: (A) Given a system of A nucleons with two-body interactions, what are the relevant and persistent modes of clustering involved. What is the nature of the correlated nucleon groups which form the clusters, and what is their mutual interaction. (B) Given the cluster modes and their interaction, what systematic patterns of nuclear structure and reactions emerge from it. Are there, for example, families of states which share the same "cluster parents". Which cluster modes are compatible or exclude each other. What quantum numbers could characterize cluster configurations. There is no doubt that we can learn a good deal from the experimentalists who have discovered many of the features relevant to aspect (B). Symmetries specific to cluster configurations which can throw some light on both aspects of clustering are discussed. (auth)

19155 (ORO-4856-26, pp 67-68) CLUSTER STATES IN LIGHT NUCLEI IN A FOLDED POTENTIAL MODEL. Buck, B. (Oxford Univ.); Dover, C. B.; Vary, J. P. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

A model is outlined for three and four particle cluster states in light nuclei, in which such states are considered as bound states and resonances of a cluster-core folded potential. The energy spectra, B(E2) values, alpha widths and r.m.s. radii of these states are calculated for ^{18}O and ^{20}Ne, and are in good agreement with experiment. The model is also used to provide dynamical support for high spin assignments for states in ^{19}N and ^{19}O seen strongly in heavy ion three particle transfer reactions. The model is also useful as a predictive tool in estimating the energies of other high spin cluster states in a variety of nuclei. (auth)

19156 (ORO-4856-26, pp 77-78) APPLICATION OF THE STOCHASTIC VARIATIONAL METHOD TO THE CALCULATION OF 3 alpha- AND 4 alpha-SYSTEMS. Kukulin, V. I.; Krasnopol'skii, V. M. (Moscow State Univ.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The results of calculations of the properties of 3 alpha- and 4 alpha-systems carried out within the framework of the recently suggested stochastic variational method are presented. As the alpha-alpha potentials, two different types of potentials are used: the Ali-Bodmer repulsive core potential and the deep attractive alpha-alpha potential with forbidden states. In the latter case the pseudopotential approach we have earlier suggested is used. The energies of levels, (r^2) and form-factors of the ground state $F(q^2)$ are calculated. (auth)

19157 (ORO-4856-26, pp 89-106) UNIFIED THEORY OF THE NUCLEUS. Wildermuth, K. (Univ., Tuebingen, Ger.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The different phenomena which play a role in low energy nuclear physics, such as reactions and bound state properties of the nuclei, are considered from a unified microscopic point of view. To achieve this the microscopic, many-particle Schroedinger equation is formulated as a projection equation. Consequently basis wave functions can be introduced which describe the nuclear system under consideration in a very flexible way, adjusted to the experimental conditions. This means for instance that the basis wave functions can be chosen in such a way that the incoming and reaction channels are contained in a completely symmetric way in the related coupled-channel equations. The specific experimental situation which one wants to describe is then taken into account by the boundary conditions of the solutions of the coupled-channel equations. One central point of this theory is the influence of the Pauli principle which resolves for instance the seemingly contradictory features of many nuclear phenomena such as e.g., single particle features and collective features. 3 figures. (auth)

19158 (ORO-4856-26, pp 107-118) FUNDAMENTALS OF NUCLEAR REACTIONS ANALYZED WITH THE HELP OF MICROSCOPIC CALCULATIONS. Hackenbroich, H. H. (Univ., Cologne). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Basic ideas of microscopic calculations of nuclear reactions are briefly stated; the main topic will be the discussion of some calculations for light nuclear systems and their consequences for the understanding of nuclear reaction mechanisms. (auth)

19159 (ORO-4856-26, pp 119-143) SCATTERING AND REACTION CALCULATIONS WITH THE RESONATING-GROUP METHOD. Tang, Y. C.; Thompson, D. R. (Univ. of Minnesota, Minneapolis). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Over the past years, many scattering and reaction calculations using the resonating-group method have been performed. These calculations have yielded not only satisfactory agreement with experimental results but also valuable knowledge concerning especially the importance of the Pauli principle in nuclear systems. The progress made in this field is reviewed, the information one has learned from these calculations is discussed, and the types of problems currently accessible to this approach are indicated. (auth)

19160 (ORO-4856-26, pp 146-147) NEW CLUSTER MODEL OF NUCLEAR REACTIONS. Redish, E. F.; Tandy, P. C. (Univ. of Maryland, College Park). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19161 (ORO-4856-26, pp 148-149) POSITIVE ENERGY BOUND STATES IN THE CLUSTER MODEL. Clement, D.; Schmid, E. (Univ., Tuebingen, Ger.). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19162 (ORO-4856-26, pp 150-151) INFLUENCE OF THE CONTINUUM ON THE WIDTHS OF RESONANCE LEVELS. Barz, H. W.; Rotter, I. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19163 (ORO-4856-26, pp 152-153) SYMMETRY OF THE T MATRIX IN REACTIONS PRODUCING AN ISOBARIC MULTIPLET. Braun-Munzinger, P.; Gelbke, C. K.; Harney, H. L.; Agassi, D. (Max-Planck-Institut fuer Kernphysik, Heidelberg). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19164 (ORO-4856-26, pp 154-155) APPROXIMATE CALCULATION OF BREAKUP AMPLITUDES IN THE UNIFIED MICROSCOPIC NUCLEAR THEORY. Schwager, J. (Univ., Tuebingen, Ger.). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19165 (ORO-4856-26, pp 157-158) PSEUDO-POTENTIAL METHOD FOR TAKING INTO ACCOUNT THE PAULI PRINCIPLE IN CLUSTER SYSTEMS. Krasnopol'skii, V. M.; Kukulin, V. I. (Moscow State Univ.). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
In order to take account of the Pauli principle in cluster systems (such as 3 alpha, alpha + alpha + n) a convenient method of renormalization of the cluster-cluster deep attractive potentials with forbidden states is suggested. The renormalization consists of adding projectors upon the occupied states with an infinite coupling constant to the initial deep potential which means that we pass to pseudo-potentials. The pseudo-potential approach in projecting upon the noneigenstates is shown to be equivalent to the orthogonality condition model of Saito et al. The orthogonality of the many-particle wave function to the forbidden states of each two-cluster sub-system is clearly demonstrated. (auth)

19166 (ORO-4856-26, pp 167-181) CLUSTER MODEL REVISITED. Tombrello, T. A. (California Inst. of Tech., Pasadena). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
A selective review is presented of recent data that bear upon cluster phenomena in several light nuclei. Rather than attempting to provide a general catalog of such examples, I shall mainly emphasize those open questions, whose answers may provide a more definitive view of nuclear clustering. To this end, particular states of mass 4, 5, 6, 7, and 8 nuclides will be examined. 8 figures. (auth)

19167 (ORO-4856-26, pp 205-219) PAULI EXCLUSION PRINCIPLE AND EFFECTIVE POTENTIAL INTERACTION OF COMPOSITE PARTICLES -ON AND OFF THE ENERGY SHELL. Neudatchin, V. G. (Moscow State Univ.). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
The manifestation of the Pauli principle in the interaction of complex nuclear systems is discussed. 28 references. (BJG)

19168 (ORO-4856-26, pp 222-223) EFFECTIVE INTERACTION AND THE ION-ION INTERACTION ENERGY. Sinha, B. (King's Coll., London). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19169 (ORO-4856-26, pp 224) EXCHANGE CONTRIBUTIONS TO PROTON INELASTIC SCATTERING FROM COLLECTIVE NUCLEI. Tedder, P. W.; Edwards, V. R. W.; Sinha, B. C. (King's Coll., London). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
The residual potential which, in the DWBA, leads to the excitation of low-lying collective states has previously been calculated by deforming the phenomenological optical potential which had reproduced the observed elastic scattering. An alternative method is to deform the nuclear density distribution and then to fold this into a nucleon-nucleon effective interaction. (auth)

19170 (ORO-4856-26, pp 225-226) ODD-EVEN MODEL WITH PAULI REPULSIVE CORE FOR $^{3}H + {}^{4}He$ SCATTERING. Partridge, R. A.; Brown, R. E.; Tang, Y. C.; Thompson, D. R. (Univ. of Minnesota, Minneapolis). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19171 (ORO-4856-26, pp 227) EXCHANGE EFFECTS DUE TO THE PAULI PRINCIPLE ON INTERACTION BETWEEN NUCLEI. Ando, T. (Hokkaido Univ., Sapporo); Ikeda, K.; Suzuki, Y. 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19172 (ORO-4856-26, pp 281-290) QUASIELASTIC KNOCK-OUT OF CLUSTERS: THEORY. Balashov, V. V. (Moscow State Univ.). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
Quasielastic cluster knock-out reactions and their role in nuclear reaction theory are reviewed. (7 figures, 16 references). (BJG)

19173 (ORO-4856-26, pp 293-294) FINITE-RANGE DISTORTED WAVE THEORY OF CLUSTER KNOCK-OUT REACTIONS. Park, J. Y. (North Carolina State Univ., Raleigh). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19174 (ORO-4856-26, pp 297-298) THREE-BODY MODEL OF ^{6}Li AND THE ^{6}Li—GREATER THAN alpha + d MOMENTUM DISTRIBUTION. Lehman, D. R.; Rai, M.; Ghovanlou, A. (George Washington Univ., Washington, DC). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19175 (ORO-4856-26, pp 299-300) ROLE OF SPIN-ORBIT DISTORTION IN THE THEORY OF KNOCK-OUT REACTIONS. Jackson, D. F. (Univ. of Surrey, Guildford, Eng.). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19176 (ORO-4856-26, pp 437-438) SIMPLIFIED PHENOMENOLOGY OF CLUSTER-TRANSFER REACTIONS. Noble, J. V. (Univ. of Virginia, Charlottesville). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).
In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).
A simple approximation for cluster-transfer reaction amplitudes in the framework of the strong absorption model is derived by making use of the observation that the PWBA amplitudes for many such reactions are strongly forward-peaked and can be represented by an exponential in cos theta. (auth)

19177 (ORO-4856-26, pp 439-452) CLUSTER SPECTROSCOPIC FACTORS: CONCEPT AND PRACTICE. Kurath, D. (Argonne National Lab., IL). 1975.
From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The cluster spectroscopic amplitude is defined and related to the shell model expression for this quantity. The SU_3 representation is particularly suited for transfer of spatially symmetric clusters. Some examples of heavy ion and light ion transfer reactions are given wherein an SU_3 nuclear structure analysis indicates that such cluster transfer is the dominant feature. (auth)

19178 (ORO-4856-26, pp 454-455) ALPHA-PARTICLE SIZE EFFECTS ON ALPHA SPECTROSCOPIC AMPLITUDES. Hecht, K. T.; Sato, H. (Univ. of Michigan, Ann Arbor). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19179 (ORO-4856-26, pp 458-459) ALPHA-TRANSFER REACTIONS AND THE PAIRING-VIBRATION MODEL. Betts, R. R. (Niels Bohr Inst., Copenhagen). 1975.

From second international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19180 (ORO-4856-26, pp 460-461) ALPHA-DEUTERON VERTEX CONSTANT OF ^{6}Li. Lim, T. K. (Drexel Univ., Philadelphia). 1975.

From second international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The alpha-deuteron structure of the ground state of ^{6}Li has been studied theoretically through phenomenological, resonating-group structure, shell model, and pole approximation methods. The asymptotic normalization constant of the alpha-d intercluster wave function is directly related to the ^{6}Li:-alpha-d vertex constant C. Tabulated values of C^2 are given and possible sources of errors are discussed. 22 references (BJG)

19181 (ORO-4856-26, pp 465-499) NUCLEAR MOLECULAR STATES. Bromley, D. A. (Yale Univ., New Haven). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Molecular phenomena occurring in heavy ion collisions are examined. (BJG)

19182 (ORO-4856-26, pp 500-521) NUCLEAR MOLECULAR STATES. Abe, Y. (Kyoto Univ.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The effects of polarization on the stability of alpha-cluster structures in ^{8}Be and ^{12}C nuclei are studied in the intrinsic states. The extent of the polarization of alpha-clusters is investigated by employing a molecular-orbital model. Two alpha-cluster structure of ^{8}Be is shown to be extremely stable, and a triangular configuration of three alpha-clusters is also shown to be stable, but the polarizations of alpha-clusters are found rather large. Gruemmer–Faessler's method is discussed and their results are shown to be trivial. (auth)

19183 (ORO-4856-26, pp 542) SELF-CONSISTENT CALCULATIONS FOR HIGHLY CONSTRICTED NUCLEAR SHAPES, DEMONSTRATED FOR ^{16}O + ^{16}O. Zint, P. G.; Passler, K. H.; Mosel, U. (Univ., Giessen, Ger.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19184 (ORO-4856-26, pp 543-544) TRI-NUCLEAR CLUSTER STRUCTURES MEDIATED BY AN ALPHA-PARTICLE. Ikeda, K.; Suzuki, Y. (Niigata Univ., Japan). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The theoretical arguments for the possible existence of the tri-nuclear cluster structures in connection with the empirical properties of these molecular resonances in ^{12}C + ^{16}O scattering are reviewed. (auth)

19185 (ORO-4856-26, pp 545-546) SEARCH FOR AN ALIGNED STRUCTURE OF THE TYPE ^{12}C + alpha + ^{12}C AT HIGH EXCITATION ENERGY IN ^{28}Si. Scheurer, J. N. (CEN, Bordeaux–Gradignan, France); Burnereau, N.; Bertault, D.; Quebert, J. L.; Fouan, J. P. 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

19186 (ORO-4856-26, pp 549-561) MANY NUCLEON CORRELATIONS IN LIGHT NUCLEI. Harvey, M. (Atomic Energy of Canada, Ltd., Chalk River, Ont.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

A demonstration is presented of how simple "back-of-the-envelope" considerations help in the understanding of how nucleons behave in a clustering environment. The compatability of different model representations of the same many nucleon states is discussed. (auth)

19187 (ORO-4856-26, pp 565-585) THEORY OF NUCLEAR FISSION: PRESENT STATUS AND PROSPECTS. Mosel, U. (Univ., Giessen, Ger.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

General properties of nuclear fission are reviewed and related to our present knowledge of fission theory. For this purpose the basic reasons for the shape of the fission barriers are discussed and their consequences compared with experimental results on barrier shapes and structures. Special emphasis is put on the asymmetry of the fission barriers and mass-distributions and its relation to the shells of the nascent fragment clusters. Finally the problem of a dynamical description of fission and its relation to the question of viscosity is discussed. (auth)

19188 (ORO-4856-26, pp 587-588) MACROSCOPIC–MICROSCOPIC APPROACH TO A CLUSTER-REPRESENTATION OF FISSION. Schultheis, H.; Schultheis, R.; Wildermuth, K. (Univ., Tuebingen, Ger.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (US). Dept. of Physics and Astronomy).

The application of cluster representations for calculating shell correction energies relates nuclear deformations to cluster amplitudes. Results are given concerning the minima of potential energy surfaces and the mass asymmetry in fission. (auth)

19189 (ORO-4856-26, pp 595-596) ROTATIONAL INSTABILITY OF SUPERHEAVY NUCLEI: A MACROSCOPIC–MICROSCOPIC DESCRIPTION. Mustafa, M. G.; Kan, K. (Univ. of Maryland, College Park). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In clustering phenomena in nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

The instability towards fission of rotating compound nuclei in the superheavy mass region (formed, for example, by heavy ion collisions) is studied. The investigation is carried out by calculating the effective potential energy surfaces and hence the fission barriers of rotating nuclei with a macroscopic–microscopic method. The method takes into account nuclear shell and pairing effects in the effective potential energy as opposed to the macroscopic method of Cohen, Plasil and Swiatecki, who have calculated fission barriers of rotating charged liquid drops. (auth)

19190 (ORO-4856-26, pp 601-614) ALPHA WIDTHS FROM NUCLEAR MODELS. Mang, H. J. (Univ., Muenchen, Ger.). 1975.

From 2nd international conference on clustering phenomena in nuclei; College Park, Maryland, USA (21 Apr 1975).

In Clustering Phenomena in Nuclei: II. (Maryland Univ., College Park (USA). Dept. of Physics and Astronomy).

Methods to calculate alpha widths from nuclear model wavefunctions are reviewed and the underlying assumptions discussed. Comparison of experimental and calculated reduced widths is made. Some new results on absolute values of alpha transition rates are reported. (auth)

19191 EXCITATION SPECTRUM OF α-PARTICLE NUCLEAR MATTER AND COLLECTIVE RESONANCES. Kitazoe, Y.; Sano, M. (Osaka Univ.). Lett. Nuovo Cim., 14: No. 8, 283-289(25 Oct 1975).

The properties of a nucleus as alpha-particle nuclear matter are explored rather than the molecular aspects, in order to get

some insight into the characteristic behavior of the nucleus at high excitation energy. It is shown that the excitation spectrum of the system exhibits a behavior similar to that of liquid helium which switches gradually from photons to single-particle type passing through rotons and also the cross sections in nuclear reactions have a resonance peak around twice the energy of the extremum point of the phonon-roton dispersion curve. (JFP)

19192 HIGHER-ORDER CONTRIBUTIONS TO THE PROBABILITY FOR $0^+ \rightarrow 0^+$ β TRANSITIONS IN NUCLEI FAR FROM THE β-STABILITY BAND. Berlovich, E. E.; Golubev, O. M.; Novikov, Yu. N. (Physical-Technical Inst., Kazan). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1507-1509(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1695-1698 (Aug 1970).

The mass differences between neighboring isobars far from the β-stability band are large and according to rough estimates may reach ~20 to 30 MeV so it would be interesting to consider the higher order contributions to the probability for $0^+ \rightarrow 0^+$ β transitions among these nuclei. To obtain numerical estimates of the higher-order contributions, a calculation was made of the defined function G, for β-emitters with nuclear charges Z of 10, 40, and 80, and transition energies between 5 and 50 MC^2, and the results are shown. (JFP)

19193 MICROSCOPIC FOUNDATIONS OF THE OPTICAL MODEL. Amus'ya, M. Ya.; Starodubskii, V. E. (Physical-Technical Inst., Kazan). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1510-1516(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1699-1706 (Aug 1970).

The purpose is to show, on the basis of the equivalence between the optical potential and the intrinsic energy operator of many-body theory, that the complex potential must be modified in a certain way, and in particular, that the potential V = U + iW must be replaced by V = U + iPW, where P is the operator for projection onto the unoccupied states. Such a modification leads to a nonlocal potential. An expression is derived for the scattering phases due to this additional nonlocal term and also a local potential is given that is approximately equivalent to the additional nonlocal one. In deriving the optical-model equation one uses the nuclear photoeffect as an example. (JFP)

19194 SELECTION RULES FOR SPIN-ORBITAL INTERACTION IN PROBLEMS WITH AXIAL SYMMETRY. Marshalkin, V. E. (Tomsk Polytechnic Inst., USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1581-1584(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1778-1781 (Aug 1970).

In calculating the single-particle spectrum of highly deformed nuclei or nuclei undergoing fission one has to calculate the spin-orbital interaction. As a rule, in making such calculations one assumes axial symmetry but uses the eigenfunctions of a single-particle Hamiltonian with a spherically symmetric potential as the zeroth approximation (basis) wave functions. A treatment using the single-particle functions of the axially deformed system as basis functions would certainly be of interest. Such a treatment is given. (JFP)

19195 CHOICE OF PARAMETERS FOR THE WOODS-SAXON POTENTIAL FROM OBSERVED NUCLEON-NUCLEON SCATTERING PHASES AT $0 < E_{c.m.} < 100$ MeV. Zhurina, M. I.; Obukhovskii, I. T.; Popova, A. M.; Ter-Martirosyan, K. A. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 8, 1591-1593(Aug 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (25 Jan 1969). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 8, 1789-1792 (Aug 1970).

No less than 23 parameters are needed to describe the results of a phase analysis of nucleon-nucleon (N-N) scattering. However, it is of great interest to approximate the results of phase analysis via an exact solution to Schrödinger's equation with some simple interaction potential, since that potential can then be used for analytic continuation of the two-particle T matrix beyond the energy shell in terms of known functions in separable form. Such a representation of the T matrix allows one to reduce Fadeev's equations to a one-dimensional system of integral equations. (JFP)

19196 NUCLEON-NUCLEON INTERACTION AND THE AVERAGE FIELD OF THE NUCLEUS, A SURVEY. Babikov, V. V. (Joint Inst. for Nuclear Research, Dubna, USSR). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1813-1824(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2034-2047 (Oct 1970).

Papers published in the last two years are surveyed from which one can form some idea of the present situation in the theory of nuclear forces and of its possible future development. Also the possibility of applying the meson theory of nucleon-nucleon interactions to the description of heavy nuclei in the Thomas-Fermi statistical approximation is discussed. In this connection results are presented of recent studies in which the statistical approach to nuclear structure has been used. (JFP)

19197 STRUCTURE OF THE GROUND AND EXCITED STATES IN A THREE-BODY PROBLEM WITH NONLOCAL FACTORIZABLE POTENTIALS. Kukulin, V. I.; Korennoi, V. P. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1961-1963(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2198-2200 (Oct 1970).

The solution to Fadeev's equations was used to investigate a system of three identical bosons whose interactions are described by a Yamaguchi S wave nonlocal factorizable potential. The energies E_{gr} and E_{ex} of the ground and excited states as functions of the two-particle binding energy ϵ (for a given β) were examined for a relatively long-range pair potential ($\beta = 0.736$ $fermi^{-1}$) and for a short-range one ($\beta = 3.00$ $fermi^{-1}$). It is confirmed that the second O^+ state in carbon-12 is cigar-shaped. (JFP)

19198 ELECTRON SCATTERING BY NUCLEI WITH EMISSION OF SEVERAL BREMSSTRAHLUNG PHOTONS. Nadzhafov, I. M. (Moscow State Univ.). Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1970-1974(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2209-2213(Oct 1970).

Two-, three-, and four-photon bremsstrahlung, including the circular polarization of the photons and longitudinal polarization of the electrons is considered. Mainly new results obtained very recently are presented. Angular and energy distributions in 2γ bremsstrahlung are investigated. (JFP)

19199 FEATURES OF LEVELS IN MAGIC NUCLEI ARISING FROM EXCITATION OF NUCLEONS FROM FILLED SHELLS. Peker, L. K. Bull. Acad. Sci. USSR, Phys. Ser.; 34: No. 10, 1980-1982(Oct 1970).

From 20th annual conference on nuclear spectroscopy and nuclear structure; Leningrad, USSR (28 Jan 1970). Translated from Izv. Akad. Nauk SSSR, Ser. Fiz.; 34: No. 10, 2220-2222 (Oct 1970).

Attention is drawn to the fact that in magic nuclei there can exist levels due to the excitation of nucleons from a filled shell which has a much lower energy. (JFP)

19200 TWO-NUCLEON TRANSFER REACTIONS BETWEEN HEAVY IONS. Elbaz, E.; Nahabetian, R.; Meyer, J. (Univ. Claude Bernard, Villeurbanne, France). Nuovo Cim.; 28A: No. 3, 305-320(1 Aug 1975).

An exact treatment of the one-nucleon transfer reactions may serve as a starting point for an exact evaluation of the two-nucleon transfer reactions. The general expansion of a function of the sum of three vectors and some extensions of well-known formulae is given. The two-nucleon transfer amplitude is then expressed including antisymmetrization. Derivations of no-recoil treatment, local-momentum approximation and full treatment, including finite-range and recoil effects, are given. (auth)

19201 FORMATION OF HIGH-ENERGY DEUTERONS IN COLLISION OF PROTONS WITH ATOMIC NUCLEI. Nagornyi, S. I.; Inopin, E. V. (Physical-Technical Inst., Kharkov). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 5, 788-798(May 1975). (In Russian)

The process of deuteron formation in the reactions of quasi-elastic scattering of high energy protons by light nuclei is considered. General expressions are obtained for the reaction cross sections and for the effective numbers of singlet and triplet deuterons. It is shown that the formation of high-energy deuterons is caused by the mechanism of heavy stripping on the two-nucleon cluster. The process under study is shown to be in satisfactory agreement with the experimental data only if the short-acting nucleon-nucleon correlations are introduced. The role of the reactions A(ppd) A-2 in studying the nucleon correlation in the atomic nuclei is discussed. (4 figures) (auth)

19202 MODELS FOR AXIAL BLOCKING IN LIFETIME MEASUREMENTS. Malaguti, F.; Verondini, E. (Univ., Bologna). Nuovo Cim.; 28A: No. 2, 240-252(21 Jul 1975).

Three models based on the idea that thermal vibrations in the emitting atom are important in blocking phenomena, and that particles are detected within a solid angle Ω if emitted beyond a distance r_c from the string, are discussed. These models give essentially the same fit to $R(\nu\tau)$ as Monte Carlo calculations, but a better one than those neglecting vibrations in the emitting atom. They can be partly justified by the assumption that ion motion through the crystal conserves the transverse energy, provided that one uses an appropriate string potential that does contain implicitly the major effects of multiple scattering. Reasons in support of this hypothesis are given; the "effective" potential is roughly evaluated for the present situation. (auth)

19203 CLASSIFICATION OF ENERGY STATES FOR SEVERAL PARTICLES. Simenog, I. V. (Inst. of Theoretical Physics, Kiev). Ukr. Fiz. Zh. (Russ. Ed.); 20: No. 8, 1290-1297(Aug 1975). (In Russian)

The wave functions of the system A of interacting particles with oscillator potentials corresponding to the lowest shells are found in the explicit form. These functions are used for the analysis of the ground states of nuclei with $A \leq 6$. (auth)

19204 HYPERSPHERICAL-EXPANSION APPROACH AND SHELL MODELS. Trlifaj, L. (Inst. of Physics, Prague). Czech. J. Phys.; 25: No. 10, 1099-1118(1975).

By means of Talmi integrals the matrix elements of nuclear interaction in the set of radial differential equations of the hyperspherical-expansion approach are related to the elements of usual shell models. The introduced average field equated to the diagonal element of the core reproduces the form of the effective (two-body) cut-off oscillator. The corresponding eigenvalue problem with a flat (heavy nuclei) and rounded (light nuclei) alternative for the well is solved and compared with the phenomenological relations: the asymptotic saturation can be achieved for the flat well. Using these results the starting set is transformed into the set of integral equations by means of the Green's functions. Then it is, successively, reduced to the eigenvalue equations of usual shell models identical for both the well alternatives. Compared with the usual models some improvements apply and the oscillator length is given automatically. (auth)

19205 CLAUDE BLOCH SCIENTIFIC WORKS. Volume 1. Balian, R.; De Dominicis, C.; Gillet, V.; Messiah, A. (eds.). Amsterdam; North-Holland Publishing Company (1975). 817p. (In French and English).

The French physicist Claude Bloch worked in several areas of modern physics including nuclear structure and reactions, statistical mechanics, the many-body problem, and perturbation theory. This volume comprises (except for minor or redundant writings) reprints of his published articles, reports, and lecture notes to 1964. A biographical article includes an exhaustive bibliography of his works. (RWR)

19206 CLAUDE BLOCH SCIENTIFIC WORKS. Volume 2. Balian, R.; De Dominicis, C.; Gillet, V.; Messiah, A. (eds.). Amsterdam; North-Holland Publishing Company (1975). 516p. (In French and English).

This volume comprises reprints of the major published articles, reports, and lecture notes of Claude Bloch from 1964. (RWR)

19207 π-CONDENSATE AND SCATTERING OF PIONS BY NUCLEI. Kirichenko, N. A. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 68: No. 6, 1997-2009(Jun 1975). (In Russian).

The possibility of observing π-condensate in nuclei by means of π-meson experiments is considered. For this purpose the density modulation amplitude of nuclear matter due to the π-condensate is calculated as well as the pion polarization operator (with frequencies $\omega \gtrsim 1$). The contribution of N^*-isobar pole to the quantities mentioned is consistently taken into account. It is shown that the main effect of the π-condensate is density modulation of the nuclear matter. The amplitude for scattering of pions by nuclei is then calculated, and the manifestations of the π-condensate in the pion scattering are analyzed. (auth)

19208 REDUCTION OF U_{15} REPRESENTATIONS INTO SU_3 IRREDUCIBLE COMPONENTS. Krishna Brahman, K. V.; Ratna Raju, R. D. (Andhra Univ., Waltair, India). At. Data Nucl. Data Tables; 16: No. 2, 165-178(Aug 1975).

The irreducible representations of U_3 contained in a given partition of U_{15} are calculated by means of the plethysm of S-functions. The results are given for partitions of up to ten boxes. (auth)

19209 NUCLEAR STRUCTURE. Volume II. Nuclear Deformations. Bohr, A.; Mottelson, B. R. Reading, MA; Addison-Wesley/W. A. Benjamin, Inc. (1975). 763p. $37.50.

Volume II, together with Volume I, contains a systematic treatment of the basis that has been gradually established during the last decades for understanding the vast body of data on nuclear properties and reactions. The presentation involves partly a development of the theoretical concepts and mathematical tools and partly a critical analysis of experimental results in terms of these concepts. While the first volume is concerned with single-particle motion and the formulation of symmetries, the second volume deals with collective rotational and vibrational motion as well as with the coupling of single-particle motion to the collective degrees of freedom. The discussion exploits several different levels of presentation, and this has motivated the division of the material into text, illustrative examples, and appendices. The text represents an attempt at a systematic development of the subject, in which each section is based on the concepts explained in previous sections. The comparison of theoretical concepts with the experimental evidence is contained in the illustrative examples; these examples are worked out in considerable detail and involve the full arsenal of available theoretical tools. The appendices are devoted to the development of general tools of quantal theory and to the analysis of idealized models that provide useful insight into various aspects of nuclear structure. This division of material contributes to making the book self-contained and at the same time provides the opportunity to elucidate the problems from several different points of view without destroying the unity of the concept. The presentation reflects the authors' view of nuclear physics as part of the broad development of concepts describing quantal many-body systems ranging from atoms and condensed matter to the structure of elementary particles. (auth)

19210 MANY-PARTICLE DENSITY OF STATES IN A FINITE-DIMENSIONAL VECTOR SPACE. Das Gupta, S.; Bhaduri, R. K. (McGill Univ., Montreal, Quebec (Canada). Dept. of Physics). Phys. Lett., B; 58: No. 4, 381-383(29 Sep 1975).

It is demonstrated that the statistical mechanics methods for obtaining the density of states, when applied to a finite-dimensional vector space, lead to a Gaussian distribution in the lowest order. Successive approximations lead naturally to the Gram–Charlier series. (NL)

19211 EVALUATION OF ANGULAR MOMENTUM PROJECTED ENERGY AT SMALL DEFORMATIONS. Dalafi, H. R. (International Centre for Theoretical Physics, Trieste (Italy)). Nucl. Phys., A; 252: No. 1, 42-46(3 Nov 1975).

An expression for angular momentum-projected energy at small deformations is given which can, of course, be used for large deformations as well. Numerical calculations are carried out for the nucleus ^{120}Sn. It is shown that the Hartree–Fock–Bogolyubov theory with angular momentum projection always produces non-spherical equilibrium shapes. (NL)

19212 ASYMMETRY AND ENERGY SPECTRUM OF HIGH-ENERGY NEUTRONS EMITTED IN POLARIZED MUON CAPTURE BY NUCLEI. Kume, K.; Ohtsuka, N.; Ohtsubo, H.; Morita, M. (Osaka Univ., Toyonaka (Japan). Dept. of Physics). Nucl. Phys., A; 251: No. 3, 465-478(27 Oct 1975).

Formulas for the asymmetry and energy spectrum of high-energy neutrons emitted in polarized muon capture by nuclei are given in the theory of allowed and forbidden transitions, with the small components of lepton wave functions. The neutron asymmetry is explicitly given by the interferences between two transitions whose forbiddennesses differ by one unit. A large asymmetry of the neutrons and its strong energy dependence in ^{48}Ca experiments are successfully explained by taking into account a realistic reaction mechanism with the effect of channel coupling. (NL)

19213 PROPERTIES OF HEAVY ION INTERACTION POTENTIALS CALCULATED IN THE ENERGY DENSITY FORMALISM. Ngo, C.; Tamain, B.; Beiner, M.; Lombard, R. J. (Paris-11 Univ., 91–Orsay (France). Inst. de Physique Nucleaire); Mas, D. (Orleans Univ., 45 (France). Lab. de Physique); Deubler, H. H. (Technische Univ. Muenchen, Garching (F. R. Germany). Physik-Dept.). Nucl. Phys., A; 252: No. 1, 237-252(3 Nov 1975).

Properties of the real part of the interaction potential between two colliding ions are studied. The calculations are performed in the framework of the energy density formalism, using the sudden approximation. In particular, it is shown that the potential can be written as the product of a "universal" function and of a geometrical factor. The universal function itself can be parametrized in a simple way. Connections with the proximity theorem of Randrup, Swiatecki and Tsang are discussed in detail. Comparisons with other available potentials are made for a typical example. (NL)

19214 SHOCK WAVES IN COLLIDING NUCLEI. Sobel, M. I.; Bethe, H. A. (Nordisk Inst. for Teoretisk Atomfysik, Copenhagen

(Denmark)); Siemens, P. J.; Bondorf, J. P. (Niels Bohr Institutet, Copenhagen (Denmark)). Nucl. Phys., A; 251: No. 3, 502-529 (27 Oct 1975).

The circumstances under which nuclear matter at high densities can be produced in heavy-ion collisions are considered. It is argued that lab energies of a few hundred MeV per nucleon will be suitable: the matter velocity will exceed the speed of isentropic compression waves, while the nuclear matter has sufficient stopping power to generate a shock front. From the hydrodynamic conservation laws it is shown that there is a maximum attainable compression ratio $\nu_{infinity}$, determined by the thermal properties of the high-density matter. In an independent-fermion model, $\nu_{infinity} = 4$; but it can be much larger if the phase of the system changes, for example by excitation of nucleon isobars, production of π mesons, or the scalar-field condensation conjectured by Lee and Wick. The propagation of the shock front and subsequent decompression of the dense, hot matter is discussed. (NL)

19215 DO THERMAL FLUCTUATIONS DESTROY THE CONCEPT OF A CRITICAL ANGULAR MOMENTUM. Hofmann, H.; Siemens, P. J. (Niels Bohr Institutet, Copenhagen (Denmark)). Phys. Lett., B; 58: No. 4, 417-419(29 Sep 1975).

The influence of thermal fluctuations in heavy ion-induced deep inelastic and fusion reactions is estimated by means of a one-dimensional Fokker–Planck equation. By approximating the fusion barrier by an inverted harmonic oscillator, an expression is found for the range of angular momenta ΔJ over which the transmission coefficient falls from 1 to 0. Numerically, ΔJ is fairly small but not insignificant, and becomes larger for incident energies near the barrier. (NL)

19216 MOMENT OF INERTIA OF NONINTERACTING NUCLEON SYSTEM. Dabrowski, J. (Institute of Nuclear Research, Warsaw (Poland)). Phys. Lett., B; 59: No. 2, 132-133(27 Oct 1975).

The expression for the moment of inertia of a system of non-interacting nucleons confined to the nuclear volume with sharp boundary is derived from the known expressions for the para- and diamagnetic susceptibilities of free electrons. (NL)

19217 FINAL-STATE NON-ADIABATIC INTERACTION IN THE PRODUCTION OF HEAVY FISSION FRAGMENTS. Bunakov, V. E.; Permiakov, V. P.; Schulz, H. (Zentralinstitut fuer Kernforschung, Rossendorf bei Dresden (German Democratic Republic)). Phys. Lett., B; 59: No. 2, 125-128(27 Oct 1975).

The effect of non-adiabatic interaction is considered for the fission fragments after the scission point. That leads to a redistribution of the internal deformation energy of a fragment and the kinetic energy of the relative motion of the fragments. This effect increases the yield of heavy fragments in fission-followed-by-fission processes. (NL)

19218 PAIR ROTATIONS AND PAIR VIBRATIONS. Hansen, O.; Nathan, O. (Niels Bohr Institutet, Copenhagen (Denmark)). Fys. Tidsskr.; 73: No. 3, 106-130(1975). (In Danish)

Pairing rotations and pairing vibrations are said to be caused by the pairing force, a force of attraction between pairs of protons or neutrons (Cooper pairs) in the atomic nucleus. This idea is the basis of a systematic field theory of the atomic nucleus, which is being worked out in order to describe conditions in the nucleus. Many nuclear phenomena can be described on the basis of Bardeen, Copper, and Schrieffer wave functions, similar to the wave functions describing the behavior of conducting electrons of superconductors. Some relevant experiments are described. (NL)

19219 DEPENDENCE OF THE CROSS SECTION FOR QUASIELASTIC CLUSTER KNOCKOUT FROM ATOMIC NUCLEI AT HIGH ENERGIES ON THE ORIENTATION OF THE RECOIL-NUCLEUS MOMENTUM. Golovanova, N.F.; Il'in, I.M.; Neudachin, V.G.; Smirnov, Yu.F.; Chuvil'skii, Yu.M. (Nuclear Physics Institute of the Moscow State University). JETP Lett. 22: No. 2, 50-51 (20 July 1975).

Within the framework of the theory developed in [1] for quasielastic cluster knockout from nuclei by fast hadrons, a new qualitative rule is derived, namely that the cross section depends on the angle between the incident beam and the recoil-nucleus momentum; this dependence was never investigated experimentally before. (auth)

19220 HYDRODYNAMIC LIMIT FOR VOLUME OSCILLATIONS OF THE NUCLEUS IN THE THEORY OF FINITE FERMI SYSTEMS. Rumyantsev, B.A. (Nuclear Physics Institute, Siberian Division, USSR Academy of Sciences). JETP Lett. 22: No. 2, 51-52 (20 July 1975).

A hydrodynamic limit corresponding to volume oscillations of the nucleus is obtained in the theory of finite Fermi systems. A nuclear analog of the Cerenkov, namely generation of a density shock wave in nuclear reactions, is discussed. (auth)

19221 ON-SHELL THEORY OF TWO-STEP PROCESSES. Mangoli, V.; Robson, D. (Florida State Univ., Tallahassee (USA). Dept. of Physics). Nucl. Phys., A; 252: No. 2, 354-364(10 Nov 1975).

A general and exact distorted-wave theory of multi-step processes is discussed which involves only transition amplitudes to intermediate states which conserve energy. Two-step processes are identified with those terms in the general theory for which the DWBA approximation can be used at each step. Conservation of energy in the intermediate stages allows the post–prior relation to be used and thus makes successive transfer amplitudes for light ions calculable via a zero-range calculation at each stage. This method is applied to the (p,t) reaction leading to the (unnatural-parity state (3^+) in the ^{206}Pb nucleus. Interference between intermediate states involving triplet and singlet deuterons is investigated and found to be less than previously predicted. The (p yields d yields t) process is found to be the dominant two-step process for the ^{208}Pb(p,t)^{206}Pb(3^+) reaction at E/sub p/ equals 35 MeV. (NL)

19222 CALCULATIONS OF HARMONIC OSCILLATOR BRACKETS. Feng, D. H.; Tamura, T. (Texas Univ., Austin (USA). Center for Nuclear Studies). Comput. Phys. Commun.; 10: No. 2, 87-97(Aug 1975).

Oscillator brackets are used in various aspects of nuclear structure and reaction calculations. The program calculates these very rapidly. The method is to use a closed form for an oscillator bracket as given by Baranger and Davies (1966), and then to calculate simultaneously a large number of brackets that have different sets of principal quantum numbers for a given set of angular-momentum quantum numbers. Restrictions come about only through the size of the core storage assigned by the DIMENSION statements. The storage presently assigned will meet the needs of most present-day nuclear physics calculations. The running time of the program ranges roughly from 600 to 1000 brackets per second of CP time on the CDC 6600 computer at the computer center of the University of Texas. (NL)

19223 LOWEST-ORDER CONSTRAINED VARIATIONAL METHOD FOR SIMPLE MANY-FERMION SYSTEMS. Alexandrov, I. (Utah Univ., Salt Lake City (USA)); Moszkowski, S. A.; Wong, C. W. (California Univ., Los Angeles (USA)). Nucl. Phys., A; 252: No. 1, 13-20(3 Nov 1975).

The authors study the potential energy of many-fermion systems calculated by the lowest-order constrained variational (LOCV) method of Pandharipande. Two simple two-body interactions are used. For a simple hard-core potential in a dilute Fermi gas, they find that the Huang–Yang exclusion correction can be used to determine a healing distance. The result is close to the older Pandharipande prescription for the healing distance. For a hard-core-plus-attractive-exponential potential, the LOCV result agrees closely with the lowest-order separation method of Moszkowski and Scott. They find that the LOCV result has a shallow minimum as a function of the healing distance at the Moszkowski–Scott separation distance. The significance of the absence of a Brueckner dispersion correction in the LOCV result is discussed. (NL)

19224 DYNAMICS AND NON-ADIABATICITY IN THE FISSION PROCESS. Schuette, G. (Heidelberg Univ. (F.R. Germany). Inst. fuer Theoretische Physik); Wilets, L. (Washington Univ., Seattle (USA). Dept. of Physics). Nucl. Phys., A; 252: No. 1, 21-41(3 Nov 1975).

The fission process takes a time which is not appreciably longer than single-particle times; therefore, it is not clear that the fragmentation process can be described in an adiabatic limit. In this paper the excitation of the nucleus during the deformation process is calculated both analytically and numerically within the framework of the cranking model. The model nucleus is defined by a Hamiltonian containing a deforming Nilsson-type single-particle Hamiltonian, pairing interaction, and schematic residual interaction. For this time-dependent Hamiltonian, the time-dependent Schroedinger equation is solved by (i) perturbation expansion for the analytic discussion and (ii) direct numerical procedure. For the numerical solution, the Hilbert space is confined to the BCS ground state and a limited number of two quasi-particle excitations corresponding to lowest excitation energy. Calculations have been performed for a vibrating calcium and a fissioning uranium nucleus. (NL)

19225 RESONANCE LINE SHAPES IN STRIPPING REACTIONS INTO THE CONTINUUM. Baur, G. (Kernforschungsanlage Juelich G.m.b.H. (F.R. Germany). Inst. fuer Kernphysik); Roesel, F.; Trautmann, D. (Basel Univ. (Switzerland)). Nucl. Phys., A; 252: No. 1, 77-89(3 Nov 1975).

A discussion of (d,p) stripping reactions into the continuum is given. Special attention is paid to a comparison with the corresponding neutron elastic scattering by the same target nucleus near a resonance. The neutron wave function is studied in the neighbor-

hood of a resonance by using different models. These wave functions turn out to be rather different, and this difference can influence the resonance line shape in the (d,p) stripping spectrum. This is illustrated in the case of $^{15}N(d,p)^{16}N$(unbound). Thus, under certain conditions, where the contributions of the interior region to the DWBA integral can be large, a very good knowledge of neutron wave functions is found to be necessary for an accurate description of the process. Furthermore, the reaction $^{208}Pb(d,p)^{209}Pb$(unbound) at almost "sub-Coulomb" energies (E/sub d/ equals 12 MeV) is investigated within the same models, where, because of the Coulomb barrier, the influence of the interior region is small. (NL)

19226 ZERO-POINT ENERGIES IN POTENTIAL-ENERGY SURFACES. Reinhard, P. G. (Mainz Univ. (F.R. Germany). Inst. fuer Kernphysik). Nucl. Phys., A; 252: No. 1, 120-132(3 Nov 1975).

The definition of potential-energy surfaces (PES) and mass parameters in microscopic collective theories implies a folding over a collective wave packet. Thus, the PES contains the zero-point energy (ZPE) of the packet, which should be extracted before using the collective potential any further. The paper concentrates on the kinetic energy part of the ZPE, its influence on the quantization procedure and its dependence on the wave packet form. A procedure is given to identify the ZPE and to extract it. Some of the effects are studied in the simple model of a deformed harmonic oscillator. (NL)

19227 ZERO-POINT ENERGIES IN THE TWO-CENTER SHELL MODEL. Reinhard, P. G. (Mainz Univ. (F.R. Germany). Inst. fuer Kernphysik). Nucl. Phys., A; 252: No. 1, 133-140(3 Nov 1975).

The zero-point energies (ZPE) contained in the potential-energy surfaces (PES) of a two-center shell model are evaluated. For the c.m. motion of the system as a whole the kinetic ZPE was found to be negligible, whereas it varies appreciably for the rotational and oscillation modes (about 5–9 MeV). For the latter two modes the ZPE also depends sensitively on the changing pairing structure, which can induce strong local fluctuations, particularly in light nuclei. The potential ZPE is very small for heavy nuclei, but might just become important in light nuclei. (NL)

19228 EQUATION OF STATE FOR NEUTRON MATTER AT FINITE T IN A RELATIVISTIC MEAN-FIELD THEORY. Walecka, J. D. (Stanford Univ., Calif. (USA). Inst. of Theoretical Physics). Phys. Lett., B; 59: No. 2, 109-112(27 Oct 1975).

The equation of state for neutron matter at all temperatures is presented in a relativistic mean-field theory which describes known nuclear matter. Isotherms are calculated and discussed, and some limiting analytic forms of the equation of state are given. (NL)

19229 CRITIQUE OF FOLDED POTENTIAL FOR HEAVY-ION SCATTERING. Satchler, G. R. (Oak Ridge National Lab., Tenn. (USA)). Phys. Lett., B; 59: No. 2, 121-124(27 Oct 1975).

It is pointed out that folding models are not successful in predicting the strength of the real potential near the strong absorption radius which is required by elastic scattering data. (NL)

19230 PION-EXCHANGE CONTRIBUTIONS TO THE ISOSCALAR CHARGE OPERATOR. Friar, J. L. (Brown Univ., Providence, R. I. (USA). Dept. of Physics). Phys. Lett., B; 59: No. 2, 145-149(27 Oct 1975).

Pion-exchange contributions to the isoscalar part of the charge operator are studied using the equivalence theorem and time-dependent perturbation theory. (NL)

19231 GENERALIZATIONS OF DISTORTED WAVE IMPULSE APPROXIMATION FOR NUCLEAR (π^+,π^0) REACTIONS. Eisenberg, J. M.; Gal, A. (Hebrew Univ., Jerusalem (Israel). Dept. of Physics). Phys. Lett., B; 58: No. 4, 390-394(29 Sep 1975).

It is shown that corrections to the ordinary distorted-wave impulse approximation are uniquely important for (π^+,π^0) reactions in the 3,3 region and have a significant effect toward improving agreement with the existing experiments. (NL)

19232 DISPERSION CORRECTIONS TO ELASTIC ELECTRON SCATTERING AND THE CLOSURE APPROXIMATION. DeForest, T. Jr. (Instituut voor Kernphysisch Onderzoek, Amsterdam (Netherlands)); Friar, J. L. (Brown Univ., Providence, R. I. (USA). Dept. of Physics). Phys. Lett., B; 58: No. 4, 397-401 (29 Sep 1975).

It is shown that, in contrast to the pure closure approximation, the corrected closure approximation of Friar and Rosen is not very sensitive to the value of the excitation energy omega and is in good agreement with the exact results as long as omega is reasonably small. Calculations of the effective excitation energy which should be used in the pure closure approximation show that this quantity tends to be quite small and, except for very small momentum transfers, has little resemblance with the intuitive concept of an average excitation energy. Arguments have been presented which indicate that the results of the present calculation are probably representative of all dispersion calculations and not simply a feature of the harmonic oscillator shell model which we have used. (NL)

19233 INTERPRETATION OF DECOUPLED BANDS BY THE WEAK COUPLING MODEL. Tanaka, Y.; Sheline, R. K. (Florida State Univ., Tallahassee (USA). Dept. of Physics). Phys. Lett., B; 58: No. 4, 414-416(29 Sep 1975).

The band structure and mechanism of formation of odd-A decoupled rotational bands are studied using the weak coupling model of de-Shalit. The geometrical relation between the spin of the core and the particle can be shown explicitly because of the fact that the interaction matrix elements are written in terms of the angle between these two spins. This scheme is shown to be a good representation in describing decoupled bands and to have wave functions with large overlaps with those resulting from the coupling scheme introduced by Stephens. (NL)

19234 ABRASION-ABLATION IN REACTIONS BETWEEN RELATIVISTIC HEAVY IONS. Hüfner, J.; Schäfer, K.; Schürmann, B. (Institut für Theoretische Physik der Universität and Max-Planck-Institut für Kernphysik, Heidelberg, Federal Republic of Germany). Phys. Rev. C 12: No. 6, 1888-1898 (Dec 1975).

The abrasion-ablation model for reactions between relativistic heavy ions is derived from Glauber's multiple scattering theory. Simple expressions are found for the abrasion cross section and for the excitation energy of the projectile after abrasion. Both quantities depend on nuclear densities and on the nucleon-nucleon forward scattering amplitude. They do not contain any adjustable parameters. With a very simple model for the ablation process, fragmentation cross sections for the production of individual isotopes are calculated. The agreement with experiment is good for most cases. Systematic discrepancies are observed and are analyzed in terms of an extension of the abrasion-ablation model. (auth)

19235 CALCULATION OF THE COVARIANT PION-NUCLEUS OPTICAL POTENTIAL. I. KINEMATICAL ASPECTS. Celenza, L.; Liu, L.C.; Shakin, C.M. (Department of Physics and the Institute of Nuclear Theory, Brooklyn College of the City University of New York, Brooklyn, New York 11210). Phys. Rev. C 12: No. 6, 1983-1993 (Dec 1975).

A discussion of several kinematical schemes used in the study of pion-nucleus scattering is presented. It is shown that various kinematical ambiguities of the noncovariant theories are resolved in a covariant analysis. In particular, the use of an *off-mass-shell* description for the projectile and the target particles provides a degree of freedom in the kinematical description which avoids various problems present in the noncovariant analyses. We present a comparison of the angle transformations, matrix elements, and differential cross sections obtained from the different kinematical specifications. In these comparisons we have attempted to maintain a clear separation of the dynamical and kinematical assumptions, using the same pion-nucleon interaction in the all cases considered. It is found that the large angle scattering is most sensitive to the details of the kinematical description. (auth)

19236 SOLIDIFICATION OF NEUTRON MATTER. Canuto, V.; Lodenquai, J. (Insitute for Space Studies, National Aeronautics and Space Administration, New York, New York 10025). Phys. Rev. C 12: No. 6, 2033-2037 (Dec 1975).

A new parity-conserving equation of motion is used to evaluate the ground state of a system of high density neutrons in a quantum crystal. If one form of a purely repulsive *NN* potential is employed, the ground state energy has a minimum with respect to the localization parameter in the density range appropriate to neutron star interiors, whereas it does not if a realistic *NN* potential is used. However, the values of the localization parameters α_m^{-1} corresponding to the observed minima are very close to or even less than the separation Δ between neutrons. Since the method employed here for the solid is only reliable when $\alpha_m \Delta > 1$, one cannot definitely say that an equilibrium solid state exists even in this case. (auth)

19237 SIMPLE RELATIONS FOR THE EXCITATION ENERGIES $E2$ AND THE TRANSITION PROBABILITIES $B(E2)$ OF NEIGHBORING DOUBLY EVEN NUCLIDES. Patnaik, R.; Patra, R.; Satpathy, L. (Physics Department, Berhampur University, Berhampur (Ganjam) -7, Orissa, India). Phys. Rev. C 12: No. 6, 2038-2049 (Dec 1975).

For even-even nuclei, the excitation energy $E2$ and the reduced transition probability $B(E2)$ between the ground state and the first excited 2^+ state have been considered. On the basis of different models, it is shown that for a nucleus $[N, Z]$ the relations $E2[N, Z] + E2[N + 2, Z + 2] - E2[N + 2, Z] - E2[N, Z + 2] \simeq 0$ and $B(E2)[N, Z] + B(E2)[N + 2, Z + 2] - B(E2)[N + 2, Z] - B(E2)[N, Z + 2] \simeq 0$ hold good, except in certain specified regions. The validity of these difference equations is tested with the available experimental data. The difference equation of Ross and Bhaduri is

shown to follow from our approach. Some predictions of unmeasured E2 and B(E2) values have been made. (auth)

19238 INTERPRETATION OF INVERSIONS OF SINGLE-PARTICLE LEVELS IN SELF-CONSISTENT FIELD THEORIES. Becker, R.L. (Oak Ridge National Laboratory, Oak Ridge, Tennessee 37830); Svenne, J.P. Phys. Rev. C 12: No. 6, 2067-2071 (Dec 1975).

An interpretation is offered for the level inversion that usually occurs in self-consistent field calculations when only one of a pair of symmetry-related levels is occupied: the single-particle energy of the level unoccupied in the A-particle system is its energy of removal from the $(A + 1)$-particle system. The correction of this energy to convert it to the corresponding energy in system A is simply given. When both symmetry-related levels are calculated in the same system there is no level inversion. The prescription to occupy the lowest levels should be amended to state that the energies should all correspond to removal energies from system A. (auth)

19239 CALCULATION OF THE MASS PARAMETER IN THE THEORY OF SELF-CRANKED GENERATOR COORDINATES. Wilets, L. (Department of Physics, University of Washington, Seattle, Washington 98195); Tuerpe, D.R.; Haff, P.K. Phys. Rev. C 12: No. 6, 2088-2093 (Dec 1975).

The self-cranked generator coordinate (SCGC) method of Haff and Wilets, together with constrained Hartree-Fock-Bogoliubov wave functions, has been used to calculate the mass parameter B_Q for quadrupole deformations. A simple ansatz reduces the required integrals to a form similar to that required in Hartree-Fock calculations, and the same matrix elements of the Hamiltonian occur in both cases. The results are sensitive to numerical approximations and care must be exercised to maintain accuracy. Since the SCGC method adds another variational function, the energy is lowered relative to the usual generator coordinate method, and hence B_Q is increased. For a particular sample calculation, the correction more than doubled B_Q. (auth)

19240 CONSTRAINED HARTREE-BOGOLIUBOV SOLUTIONS AS A BASIS FOR TIME-DEPENDENT CALCULATIONS. Schütte, G. (Institut für Theoretische Physik der Universität Heidelberg, 6900 Heidelberg 1, Germany); Wilets, L. Phys. Rev. C 12: No. 6, 2100-2102 (Dec 1975).

Starting from static constrained Hartree-Fock solutions, a numerically tractable method is proposed to study the inner excitation of a nucleus during collective deformations like fission. A prescription is proposed to determine the dynamics of one collective degree of freedom. (auth)

19241 PAIRING BACKBENDING. Hussein, M.S.; Chen, H. (Pelletron Laboratory, Instituto de Física, Universidade de São Paulo, São Paulo, Brazil). Phys. Rev. C 12: No. 6, 2103-2105 (Dec 1975).

We argue for the possible existence of backbending in pairing rotation that can be checked by a sequence of four-nucleon transfers. This effect corresponds to the transition from pairing vibration to pairing rotation. (auth)

19242 ENERGY-DEPENDENT HAMILTONIANS, CHARGE DENSITIES, AND RECOIL EFFECTS. Friar, J.L. (Department of Physics, Brown University, Providence, Rhode Island 02912). Phys. Rev. C 12: No. 6, 2127-2129 (Dec 1975).

Two recent papers are shown to be related, and the unifying ingredient is an energy-dependent Hamiltonian. (auth)

19243 THE VARIATION PROBLEM IN THE THEORY OF DENSE FERMI LIQUIDS. Krotscheck, E. Koeln, Ger.; Koeln Univ. (1974). 141p. (In German). INIS.

Thesis.

The factorized form of the Iwamoto-Yamada expansion for the energy expectation value coupled with a variation process for the short-range behavior of the pair correlation function is numerically investigated using the example of ^{3}He and nuclear matter. Satisfactory results are already obtained in 3-particle approximation for nuclear matter. (DE)

19244 EQUILIBRIUM PROPERTIES OF NORMAL AND DENSE FERMI LIQUID. Nitsch, J. Koeln, Ger.; Koeln Univ. (1974). 111p. (In German). INIS.

Thesis.

The renormalized and non-renormalized Iwamoto-Yamada expansions of the energy expectation value as well as the radial distribution functions obtained from these and the corresponding static structural functions for the Fermi systems ^{3}He, symmetrical nuclear matter and neutron matter, are investigated. (DE)

19245 THEORETICAL AND EXPERIMENTAL STUDY OF MAGNETIC INSTABILITIES IN MULTIFILAMENTARY Nb–Ti SUPERCONDUCTING COMPOSITES. Duchateau, J. L.; Turck, B. (CEN, Saclay, France). IEEE Trans. Magn.; MAG-11: No. 2, 350-353 (Mar 1975).

From applied superconductivity conference; Oakbrook, Illinois, USA (30 Sep 1974). See CONF-740957-.

Classical adiabatic stability criteria appear to be pessimistic for multifilamentary composites. The thermal conductivity K, the magnetic and thermal diffusivities D/sub m/ and D/sub theta/, the heat transfer coefficient h play a leading part in the determination of a stable composite. The differential magnetic and thermal equations have been solved and typical stability curves are given for either the slab model or the round conductor. Measurements of the quenching currents, in different magnetic, thermal and cooling conditions, for two meter long noninductive coils are made. The results are in good agreement with the theoretical predictions.

PHYSICS (RADIATION AND SHIELDING)

Radiation Physics

Refer also to abstracts 17231, 17232, 17240, 17722, 18352, 18380, 18414, 18758, 19251, and 19295.

19246 (GSF-K-74(Ed.3)) ORIGIN, CHARACTERISTICS AND DETECTION OF NUCLEAR RADIATION. Goettel, K. (Gesellschaft fuer Strahlen- und Umweltforschung m.b.H., Neuherberg/Muenchen (F. R. Germany). Inst. fuer Strahlenschutz). Jun 1975. 34p. (In German). INIS.

8 figs.; 3 tabs.; 5 refs.

An introduction into the physical principles of radiation protection is given. After a brief summary of the most significant experimental results and data on the atomic structure of the matter and after explaining the principles of atomic and nuclear structure, radioactive decay and its laws are dealt with. This is followed by a representation of the characteristics of nuclear radiation, its interaction with the matter as well as the biological effects. After a description of the measurement units for radioactivity and doses, the most important methods for radiation detection and the principles of how detectors function are explained. (DE)

19247 (IRI-190-74-03) MEASUREMENTS WITH A Ge(Li)-DETECTOR OF THE DOSE AS A RESULT OF BACKGROUND RADIATION IN BUILDINGS. Akkermans, J. A.; Roodbergen, C. (Interuniversitair Reactor Instituut, Delft (Netherlands)). 1974. 28p. (In Dutch). INIS.

A method has been developed by which the dose rate of all γ-radiation from a nuclide can be determined from the γ-spectrum, measured with a Ge(Li) semiconductor detector or a NaI(Tl) scintillation counter. The total dose rate of a nuclide, including possible daughter products, is being calculated from the area under one photopeak in the γ-spectrum of the nuclide. In this case, the calculated values of the proportional contribution of one γ-transition to the total dose rate as a result of all the γ-radiation emitted by the nuclide have been taken as a starting point. The dose rate resulting from one γ-transition is being calculated from the flux density of the photons under consideration which can be measured with the Ge(Li) detector. Several measurements have been carried out with a Ge(Li) detector at various locations within the "Interuniversitair Reactor Instituut". Individual contributions to the dose rate of ^{40}K, ^{226}Ra and ^{232}Th have been calculated. In spaces enclosed by concrete walls the dose rate is approximately three times as high as in rooms with wooden walls.

19248 (LA-tr-75-33) COHERENT PHENOMENA IN THE INTERACTION OF MOESSBAUER RADIATION WITH CRYSTALS (PROGRESS IN THEORY). Kagan, Yu. M. Nov 1975. Translation by H. Dahlby of Polish Report. (CONF-750815-2). 32p. Dep. NTIS $5.00.

From international conference on Moessbauer spectroscopy; Cracow, Poland (Aug 1975).

Attention is focused on the analysis of results previously obtained in the theory of the coherent phenomena accompanying resonance interaction of Moessbauer radiation with crystals. Specific sections include: stimulated radiation of gamma-quanta in a crystal under conditions of Bragg scattering, suppression of the broadening of a Moessbauer line caused by non-uniform isomer shift, and suppression of a non-uniform isomer shift under conditions of resonant optical repopulation of the electronic levels. (GHT)

19249 (ORNL-5046, pp 69-72) DISTRIBUTION OF ENERGY LOSSES OF LOW-ENERGY PROTONS IN HYDROCARBON GASES. Thorngate, J. H.; Shinpaugh, W. S. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Calibration and normalization of target and analyzer facilities for the measurement of energy losses of protons (50 to 150 keV) in hydrocarbon gases are described. Data are presented for proton energy losses in molecular hydrogen. 3 figures, 1 table. (GHT)

19250 (ORNL-5046, pp 79-92) DOSIMETRY FOR HUMAN EXPOSURES. Auxier, J. A.; Haywood, F. F.; Jones, T. D.; Warner, G. G.; Cheka, J. S.; Kerr, G. D.; Solomon, D. L.; Yamada, H. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Topics covered include: liaison dosimetry studies with the Atomic Bomb Casualty Commission; in vivo dose estimates for atomic bomb survivors; radiation exposure to atomic bomb survivors residing in the United States; and transmission of photons through common shielding media. (GHT)

19251 (ORNL-5046, pp 136-155) GENERAL PHYSICS. Anderson, V. E.; Brandt, W.; Ritchie, R. H.; Ferrell, T. L.; Hamm, R. N.; Ashley, J. C.; Neufeld, J.; Tung, C. J.; Turner, J. E.; Wright, H. A. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Topics covered include: pion beam dosimetry; estimated W values for negative pions in nitrogen and argon; Monte Carlo treatment of multiple coulomb scattering in pion-beam dose calculations; surface-plasmon excitation in x-ray inelastic scattering on spherical voids in metals; theory of the linear response function of a model insulator; application of the model insulator theory to Al_2O_3, the low-energy end of the electron slowing-down spectrum; scattering of electromagnetic waves by cylinders, excitation of surface-plasmon modes; energy loss of swift proton clusters in solids; a statistical approach to the evaluation of electron inelastic mean free paths in solids; and tabulation of electron interaction parameters in Al and Al_2O_3. 24 figures, 3 tables. (GHT)

19252 (ORNL-5046, pp 207-213) VARIATION OF THE ABSORBED FRACTION WITH SHAPE AND SIZE OF THE THYROID. Ford, M. R.; Snyder, W. S.; Warner, G. G. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Calculated values for absorbed dose to the thyroid are presented based on nine different mathematical models representing possible shapes for the organ. 7 figures, 2 tables. (GHT)

19253 (ORNL-5046, pp 214-218) DOSE TO THE BLADDER. Snyder, W. S.; Ford, M. R. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Radiation dose to the bladder is calculated based on mathematical models of the bladder for several volumes. Topics covered include: the bladder model; activity in the bladder; dose from photons; results for photon dose; and surface dose from electrons and beta particles. 2 figs, 1 table (GHT)

19254 (ORNL-5046, pp 233) ABSORBED DOSE DURING BREAST X-RAY THERAPY. Warner, G. G.; Poston, J. W. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

19255 (ORNL-5046, pp 234-238) EFFECT OF SOURCE ORGAN SIZE ON ABSORBED FRACTION DISTRIBUTION. Mei, N. H.; Warner, G. G.; Stansbury, P. S.; Poston, J. W. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

A program of measurements was performed to determine if the size of a source organ affected the absorbed fraction in various target organs. Some results from measurements in a phantom are shown compared with calculated values. 5 figs, 2 tables (GHT)

19256 (ORNL-5046, pp 247-248) VARIATION OF CALCULATED ORGAN DOSE RATES FROM A PACEMAKER AS A FUNCTION OF BODY SIZE. Snyder, W. S.; Warner, G. G. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

The study was undertaken to estimate the dependence of neutron doses to various organs from nuclear powered cardiac pacemakers on the physical size of the individual user. 1 table (GHT)

19257 (ORNL-5046, pp 249-252) AGE FACTORS FOR DOSE RATES FROM AN INFINITE CLOUD OF A PHOTON EMITTER. Poston, J. W.; Snyder, W. S.; Warner, G. G. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

The dose rates to children, or persons of smaller body size, are considered to see whether the dose estimates for the cloud are reasonably valid for the population as a whole. 4 figs, 2 tables (GHT)

19258 PRODUCTION OF NEGATIVE PIONS AND THEIR INTERACTION IN TISSUE. Bond, V. P. (Brookhaven National Lab., Upton, NY). Excerpta Med. Int. Congr. Ser.; 2: 422-425 (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A review is given of the possible modes of production of pions minus beams. The physical and radiobiological characteristics of negative pions are outlined. (NL)

19259 DOSIMETRY PROBLEMS OF NEGATIVE π-MESONS. Baarli, J.; Sullivan, A. H. (CERN, Geneva). Excerpta Med. Int. Congr. Ser.; 2: 426-431(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Problems attached to the dosimetry of pions are outlined. A description is given of a dosemeter with a tissue-equivalent chamber that is being used at the CERN pions minus facilities. (NL)

19260 PROBLEMS OF ELECTRON CONTAMINATION IN PION BEAMS. Tisljar-Lentulis, G. M. (Kernforschungsanlage, Juelich, Ger.). Excerpta Med. Int. Congr. Ser.; 2: 432-435(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A survey is given of methods which can be used for discriminating against particles contaminating pion beams. Electronic discrimination is possible for dose determinations. For biomedical applications, the number of unwanted particles in the beams has to be reduced. This can be done by making use of differences in ionization losses, of radiation losses of electrons and electrostatic particle separation. (NL)

19261 π-MESONS AND PARTICLES IN PERSPECTIVE. Fowler, J. F. (Mount Vernon Hospital, Northwood, Eng.). Excerpta Med. Int. Congr. Ser.; 2: 436-440(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

The suitabilities of negative pi-mesons, fast neutrons and fast protons for radiotherapeutic application are compared. Pions give the best spatial dose distribution. The OER in the pion peak is of the same order as that of the fast neutrons. Fast proton beams have good spatial dose distributions. Until now the availability of negative pi-mesons is limited. (NL)

19262 SPECTRA OF PRIMARY AND SECONDARY ELECTRONS. Harder, D. (Univ., Goettingen, Ger.). Excerpta Med. Int. Congr. Ser.; 2: 445-461(1974).

From 13th international congress on radiology; Madrid, Spain (15 Oct 1973).

The shift of the primary peak and the substantial constancy of the dose-normalized secondary continuum are the preponderant features of the total electron spectrum with varying depth. The changes in the secondary contribution near the practical range and the surface are well defined in the physical sense, but their ability to induce significant changes in RBE with depth is limited as a consequence of the weak population of these parts of the total spectrum. This results corresponds to the constancy of RBE with depth found in various experiments and to the discovery of slight influences of the depth on the time course of certain cellular reactions. (NL)

19263 PENDULOUS IRRADIATION WITH BETATRON ELECTRON BEAMS: ITS DOSE DISTRIBUTION AND CLINICAL APPLICATION. Ishida, T.; Matsumiya, A.; Kimura, S. (Kobe Univ., Japan). Excerpta Med. Int. Congr. Ser.; 2: 479-484(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

The combination of deflection with speed-controlled pendulous rotation of electron beams offered characteristic isodose patterns which might be useful for clinical application. Some of the patterns of clinical interest are presented. (NL)

19264 HIGH ENERGY ELECTRON DOSIMETRY AT SURFACES AND INTERFACES. Netteland, O. (NoRske Radiumhospital, Oslo). Excerpta Med. Int. Congr. Ser.; 2: 472-478 (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Radiation doses due to energy losses of fast electron beams are studied at surfaces and interfaces, using photographic film and a phantom designed for this purpose. (NL)

19265 USE OF COMPUTERS TO CALCULATE RADIATION DOSE FROM METABOLIC MODELS. Brownell, G. L.; Alpert, N. M. (Massachusetts General Hospital, Boston). Excerpta Med. Int. Congr. Ser.; 2: 523-527(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Monte Carlo methods are used to calculate radiation doses to various organs in the reference man, due to the administration of radiopharmaceuticals. (NL)

19266 GONADAL DOSE IN ROUTINE DIAGNOSTIC EXAMINATIONS. Weber, J.; Koen, J. A.; Akkermans, J. A. (Interuniversitair Reactor Instituut, Delft, Netherlands). Excerpta Med. Int. Congr. Ser.; 2: 537-542(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Gonadal doses caused by stray radiation produced during radiodiagnostic investigations were measured with thermoluminescent dosemeters in various hospitals in the Netherlands. Significantly different gonadal doses were measured depending upon the hospital where the investigations were carried out. The mean dose of an examination type in one country can only be determined with any accuracy if measurements in a large number of hospitals are performed. (NL)

19267 GONADAL DOSE IN RADIOTHERAPY. Heilmann, H. P.; Hippeli, R. (Univ., Tuebingen, Ger.). Excerpta Med. Int. Congr. Ser.; 2: 534-536(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Procedures are proposed to diminish the gonadal dose caused by stray radiation in patients who are being treated radiotherapeutically. (NL)

19268 RESIDUAL ERRORS AFTER CORRECTION FOR TISSUE INHOMOGENEITIES BY TRANSMISSION DOSIMETRY. Aird, E. G. A. (Univ. of Newcastle-upon-Tyne, Eng.). Excerpta Med. Int. Congr. Ser.; 2: 575-580(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

19269 TECHNIQUE FOR ESTIMATING THE GENETICALLY SIGNIFICANT DOSE TO THE U. S. POPULATION FROM DIAGNOSTIC X RAYS. Gitlin, J. N.; Gaskill, J. W.; Roney, P. L.; Wyckoff, H. O. (Dept. of Health, Education, and Welfare, Washington, DC). Excerpta Med. Int. Congr. Ser.; 2: 547-549(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A description is presented of a model being used in the USA to determine the genetically significant dose to the population as a consequence of radiodiagnostic procedures. (NL)

19270 CALCULATIONS FOR TISSUE INHOMOGENEITIES WITH EXPERIMENTAL VERIFICATION. Cunningham, J. R.; Beaudoin, L. (Ontario Cancer Inst., Toronto). Excerpta Med. Int. Congr. Ser.; 2: 653-657(1974).

From 13th international congress on radiology; Madrid, Spain (15 Oct 1973).

The possibility of the use of scatter-air ratios for accurate calculations for the effects of tissue inhomogeneities to be taken into account in radiotherapeutic treatment was explored. Even for extreme situations the results are accurate enough. The calculations are lengthy. The method is not to be recommended as yet. (NL)

19271 AUTOMATIC THREE-DIMENSIONAL DOSIMETRY IN ELECTRON BEAMS. Lanze, L. H.; Rozenfeld, M. (Univ. of Chicago). Excerpta Med. Int. Congr. Ser.; 2: vp.(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

19272 PLATZMAN'S ANALYSIS OF THE DELIVERY OF RADIATION ENERGY TO MOLECULES. Fano, U. (Univ. of Chicago). Radiat. Res.; 64: No. 2, 217-232(Nov 1975).

Robert L. Platzman strove for a quarter of a century to develop a quantitative picture of the delivery of energy to individual molecules by ionizing radiations—a prerequisite to the understanding of further stages of radiation action. Comprehensive results of these efforts, achieved shortly after his untimely death by several of his collaborators and students, are reviewed in this article, with emphasis on the methods that led to them. Characteristic of the methods is the skillful use of fragmentary data, resting on clear theoretical understanding and on critical knowledge of vast experimental evidence. The program involved a persistent, successful quest for whatever new experimental information seemed essential to basic understanding. The article points to the opportunity for systematic extension of the new results, thus far confined to pilot examples, as well as to the next major stage of inquiry into fundamental mechanisms. 9 figures, 53 references. (auth)

19273 DETERMINATION OF ABSORBED DOSES OF LONG-WAVE ROENTGEN AND GAMMA RADIATION WITH THE AID OF A DETECTOR OF COMPLETE ABSORPTION. Glezin, F. I.; Kronguuz, A. N.; Lyapidevskii, V. K.; Titov, A. A. (Moscow Scientific-Research Rentgeno-Radiological Inst.). Med. Radiol.; 16: No. 2, 71-75(Feb 1971). (In Russian)

The authors commit to paper the description of a detector of complete absorption for determining the integral absorbed dose and dose of roentgen radiation in the range of 4.8 to 13.4 keV in thin layers of tissue-equivalent substance. It is shown that the integral absorbed dose linearly depends upon the area of the irradiated field. (auth)

19274 INVESTIGATION OF DYNAMIC TRANSITION X-RAY PEAKS ARISING ON PASSAGE OF A PARTICLE THROUGH A

SINGLE CRYSTAL. Avakyan, A. L.; Aginyan, M. A.; Garibian, G. M.; Yang, C. (Erevan Physical Inst.). Zh. Eksp. Teor. Fiz.; 68: No. 6, 2038-2046(Jun 1975). (In Russian).

The dynamic peaks of transition X-rays arising in a thick single crystal are investigated in the Laue and in the Bragg cases. Angular and frequency spectra in the vicinity of Bragg frequencies are calculated for various values of the Lorentz-factor of an ultrarelativistic charge. The formation of dynamic peaks in intermediate thickness crystals is investigated for the particular case of reflection almost exactly backward. (auth)

19275 APPLICATION OF PROTON BACKSCATTERING IN THE ANALYSIS OF RADIATION DAMAGE IN IONIC SINGLE CRYSTALS. Mamaev, L. K.; Popov, V. S.; Shipatov, E. T. At. Energ. (USSR); 39: No. 2, 98-102(Aug 1975). (In Russian).

The backscattering and channeling of 1.2-MeV protons has been used in the analysis of radiation damage due to protons in single crystals of NaCl. The maximum value of volume density of defects $N_d = 1.5 \cdot 510^{22}$ cm^{-3} is attained for irradiation doses of $2 \cdot 10^{15}$ protons/cm^2. A further increase of dose results in a decrease in the value of the density of defects. The cross-section of formation of displaced atoms for 1.2-MeV protons is equal to $1.2 \cdot 10^{-17}$ cm^2. When the incident protons are channeled along a ⟨100⟩ crystal axis, the value of the rate of formation of defects decrease by a factor of approximately 1.6. 6 figures, 15 references. (auth)

19276 RANGES OF ^{233}U FISSION FRAGMENTS IN NATURAL ELEMENTS. Rustichelli, F. (Joint Nuclear Research Center, Ispra, Italy). J. Phys., G (London); 1: No. 7, 724-726(5 Sep 1975).

By using the theory of Lindhard et al. together with experimental data, a complete set of average ranges of ^{233}U fission fragments in all existing natural elements was evaluated. This set includes ranges for the median light fission fragment, the median heavy fission fragment and the overall median fission fragment for each stopping element. (auth)

19277 MONTE CARLO CALCULATION OF PHOTON-INITIATED ELECTROMAGNETIC SHOWERS IN LEAD GLASS. Longo, E.; Sestili, I. (Rome Univ. (Italy). Istituto di Fisica). Nucl. Instrum. Methods; 128: No. 2, 283-307(1 Oct 1975).

The results are presented of a Monte Carlo calculation of the longitudinal and lateral development of photon-initiated electron–photon cascades in SF5 lead glass for the following energies of the primary photon: 100, 300, 500, 700, 1000, and 5000 MeV. The longitudinal development has been carefully treated, and a satisfactory analytical representation is suggested as a convenient tool for many practical problems. The lateral spread has been analyzed and estimated from different points of view. Fluctuations obtained from the Monte Carlo calculation for the track length of showers within 5, 10 and 15X_0 of SF5 are presented. They have also been obtained for an array of 9 counters—each 1 × X_0 thick—placed one behind the other. These results have been interpolated rather accurately with a Polya distribution for a convenient set of values of the corresponding parameters. (NL)

19278 IMAGING AND MEASURING ELECTRON BEAM DOSE DISTRIBUTIONS USING HOLOGRAPHIC INTERFEROMETRY. Miller, A. (Danish Atomic Energy Commission, Risoe. Research Establishment); McLaughlin, W. L. (National Bureau of Standards, Washington, D. C. (USA). Center for Radiation Research). Nucl. Instrum. Methods; 128: No. 2, 337-346(1 Oct 1975).

Holographic interferometry was used to image and measure ionizing radiation depth-dose and isodose distributions in transparent liquids. Both broad and narrowly collimated electron beams from accelerators (2-10 MeV) provided short irradiation times of 30 ns to 0.6 s. Holographic images and measurements of absorbed dose distributions were achieved in liquids of various densities and thermal properties and in water layers thinner than the electron range and with backings of materials of various densities and atomic numbers. The lowest detectable dose in some liquids was of the order of a few kRad. The precision limits of the measurement of dose were found to be ±4%. The procedure was simple and the holographic equipment stable and compact, thus allowing experimentation under routine laboratory conditions and limited space. (NL)

19279 ESTIMATES OF NEUTRON LEAKAGE THROUGH PENETRATIONS OF THE CERN INTERSECTING STORAGE RINGS BY MONTE CARLO ALBEDO CALCULATIONS. Routti, J. T.; van de Voorde, M. H. (European Organization for Nuclear Research, Geneva (Switzerland)). Nucl. Eng. Des.; 34: No. 2, 293-305(Nov 1975).

The monokinetic and multigroup Monte Carlo albedo methods applicable to estimating neutron leakage through penetrations in the shielding of high-energy accelerators are reviewed. They are used to calculate attenuation factors and dose levels in the tunnels of the CERN intersecting storage rings. (NL)

19280 ABSORPTION OF 6.42 MeV PHOTONS. Moreh, R.; Wand, Y. (Nuclear Research Centre, Negev, Beer-Sheva, Israel). Nucl. Phys., A; 252: No. 2, 423-428(10 Nov 1975).

Precise measurements of the total attenuation coefficients of 6.418-MeV photons in 23 elements between Be and U were carried out with uncertainties which are generally less than 0.3%. The method utilizes resonance scattering of monochromatic photons obtained from thermal neutron capture in titanium. The resonant scatterer is ^{139}La; it serves as an analyzer of the γ-beam energies passing through the absorber. The effective definition in this method is of the order of 20 eV. The measured coefficients are generally in close agreement (~0.6%) with calculated values. A significant deviation was observed only in the case of Ta. (NL)

19281 IONIZATION YIELDS IN GASES UNDER ELECTRON IRRADIATION. Inokuti, M. (Argonne National Lab., IL). Radiat. Res.; 64: No. 1, 6-22(Oct 1975).

The total number N/sub i/(T) of ionizations that an incident electron of kinetic energy T generates in a pure gas at low pressure obeys an integral equation known as the Flower equation. Data show that its solution approximates N/sub i/(T) equals (T - U)/W/sub alpha/ for T exceeding many multiples of the first ionization energy I, where U and W/sub alpha/ are constants having the energy dimension. Attempts are made to derive formulas that express U and W/sub alpha/ in terms of various cross sections for electron inelastic collisions with a gas molecule. The paper also describes the background of the problem and includes a critique of underlying assumptions that are often left unmentioned. (auth)

19282 IONIZING COLLISIONS OF ELECTRONS WITH ATOMS AND MOLECULES. Khare, S. P. (Meerut Univ., India). Radiat. Res.; 64: No. 1, 106-118(Oct 1975).

Ionizing collisions of electrons with atoms and molecules are discussed. The calculations of ionization cross sections per unit energy range and its application to the calculation of total ionization cross sections, stopping power, mean energy expended per ion pair and fluoresent efficiency of electrons in the 50 eV–10 keV energy range carried out by Khare and his associates are reviewed. (auth)

19283 ENERGY DEPOSITION BY ELECTRONS AND DEGRADATION SPECTRA. Douthat, D. A. (Kennedy-King Coll., Chicago). Radiat. Res.; 64: No. 1, 141-152(Oct 1975).

The energy distribution of particles in an irradiated system, the degradation spectrum, is perhaps the most fundamental piece of information in a description of the radiation field acting on the system. Recent progress in the calculation of electron degradation spectra as well as some systematics of electron degradation spectra are discussed and this method is compared with other viewpoints, e.g., CSDA, Monte Carlo, and Fowler-equation calculations. Deficiencies in the available data as well as prospects for further calculations will also be discussed. (auth)

19284 ELECTRON SLOWING-DOWN SPECTRA IN SOLIDS. Ritchie, R. H. (Cambridge Univ., Eng.); Tung, C. J.; Anderson, V. E.; Ashley, J. C. Radiat. Res.; 64: No. 1, 181-204(Oct 1975).

Some theoretical methods used to describe the interaction of electrons with metals, semiconductors, and insulators are reviewed. Calculations of electron slowing-down spectra using these methods are presented for Al, Cu, Cr, Si, and Al_2O_3. Experimental electron slowing-down spectra for these materials are also presented and comparisons with theoretical calculations are discussed. (40 refs.) (auth)

19285 ENERGY LOSSES OF 37 keV-ELECTRONS IN THE SOLID RARE GASES Ne, Ar, Kr, Xe, AND IN SOLID HYDROGEN. Schmidt, L. Berlin; Technische Univ. (1972). 86p. (In German). INIS.

Thesis.

The energy loss spectra of the solid rare gases Ne, Ar, Kr and Xe as well as the solid normal hydrogen H_2 was measured using a high resolving spectrometer for 37 keV electrons with a resolution up to 0.04 eV. The condensation of the gases to thin layers took place in a He cooling component at temperatures between 3 and 60 K. The measured results exhibit very similar spectra for the solid rare gases. The loss first occurs at energies of about 10 eV with losses that can be interpreted as exciton series. In addition to the exciton series are losses which are assigned to interband transitions from both upper valency bands in the conduction bands. The energy loss spectra of solid normal hydrogen shows signs of losses which could originate in the vibration lines of the molecule and are spread over a very wide continuous spectrum. (DE)

19286 DOSIMETRIC STUDIES ON BOARD THE ORBITAL SPACE STATION SALYUT. Red'ko, V. I.; Kozlova, S. B.; Markelov, V. V.; Stepanov, A. S.; Chernykh, I. V. Kosm. Biol. Med.; 8: No. 3, 3-6(May 1974). (In Russian)

This study presents generalized data of dose studies carried out on board the space station "Salyut" by means of equipment consisting of a charged particle telescope made up of two semiconductor detectors and tissue-equivalent ionization chamber. The telescope served for the direct counting of protons, alpha particles and electrons over a number of energy ranges, and also for obtaining the integral flux of charged particles having a charge greater than 2. Amplitude analysis of the pulses from the first detector made it possible to determine the magnitude of the linear energy losses of the charged particles. The telescope was placed in an inner part of the space station, and counted radiation behind a wall requiring minimum protection. The ionization, tissue-equivalent chamber which was placed next to the telescope measured the absorbed dose from all kinds of cosmic radiation. The basic parameters calculated from the experimental data, which characterize the radiation conditions on board the space station, had the following values: absorbed dose of 11 mrad/day, equivalent dose of 13.4 mrem/day, and an average value of the radiation quality coefficient K = 1,2. (INIS)

Radiation Protection Standards

Refer also to abstracts 17239, 19246, and 19294.

19287 PROBLEMS ASSOCIATED WITH RADIATION PROTECTION LEGISLATION. Taylor, L. S. (National Council on Radiation Protection and Measurements, Washington, DC). pp 426-428 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress on radiology; Madrid, Spain (15 Oct 1973).

The necessity for having radiation control standards between all jurisdictional levels as uniform and as simple as possible is emphasized. The situation in the USA is taken as an example. (NL)

19288 NATIONWIDE EVALUATION OF X-RAY TRENDS (NEXT): AN ORGAN DOSE INDEX SYSTEM FOR EVALUATING THE EFFECTIVENESS OF X-RAY CONTROL PROGRAMS. Gaskill, J. W.; Pakenas, W. P.; Blackburn, J. A. (Bureau of Radiological Health, Rockville, MD). Excerpta Med. Int. Congr. Ser.; 2: 554-557(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Indexes of organ doses for a standard-size patient for commonly performed examinations are computed based on measurements of exposure and beam size using a specially designed test stand. This provides a method for observing the wide range of technique factors and thus the exposures and doses employed by operators of x-ray machines. Using these data, participating agencies are able to set program priorities, mount action programs to improve technique and evaluate the impact of these programs. The system design, instruction manuals, computer programs and specifications for the test stand are available to any agency interested in considering the applicability of the NEXT organ dose index system to its x-ray control program. (NL)

19289 INTERNATIONAL REGULATIONS ON RADIOPROTECTION. Legislation of Radiology. Introduction. Demoullin, M. (Hopital de la Ville, Esch-sur-Alzette, Luxemburg). pp 403-407 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress on radiology; Madrid, Spain (15 Oct 1973).

Recommendations are given to improve the radiologist's knowledge of radioprotective procedures. Also regulations dealing with responsibilities in this profession are discussed. (NL)

19290 LEGISLATION AND TEACHING IN RADIOPROTECTION. Delorme, G. (Univ., Bordeaux). pp 408-412 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

Radiation protection standards and procedures to be applied in medical investigations are outlined. Laws on radioprotection in the USA, USSR, France and a few other European countries are compared. (NL)

19291 PRINCIPLES OF RADIATION PROTECTION LEGISLATION CONCERNING THE MEDICAL APPLICATION OF X-RAYS IN EUROPEAN COUNTRIES. Bischof, W. (Univ., Goettingen, Ger.). pp 413-415 of Radiology. Vol. I. Gomez Lopez, J. (ed.). Amsterdam; Excerpta Medica (1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

A comparison is given of legislation of radiation protection in various European countries. (NL)

19292 DOSIMETRY PROGRAMS OF THE IAEA AND RESULTS OF THE JOINT IAEA/WHO POSTAL DOSE INTERCOMPARISON. Eisenlohr, H. H.; Lerch, I. A. (IAEA, Vienna). Excerpta Med. Int. Congr. Ser.; 2: 667-673(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

The IAEA has set up a postal dose intercomparison service for cobalt-60 radiation, utilizing thermoluminescent lithium fluoride powder as the dosimetry substance. Often improvement in dosimetry was observed in institutions during participation in the project. In many countries, the state of radiotherapy is not as good as it should be to achieve optimal results. Technical shortcomings might be one reason but a more likely factor is the lack of trained personnel and the lack of awareness of the need for good dosimetry. (NL)

19293 NEED FOR STANDARDS FOR NATURAL AIRBORNE RADIOACTIVITY (RADON AND DAUGHTERS) CONCENTRATIONS IN MODERN BUILDINGS. Caruthers, L. T.; Waltner, A. W. (North Carolina State Univ., Raleigh). Health Phys.; 29: No. 5, 814-817(Nov 1975).

Data obtained as a result of a survey of the natural airborne radioactivity measured in various modern buildings and laboratories on a University campus and surrounding private homes are presented. From these data the need for increased ventilation to reduce the reported ^{222}Ra air activity in the Physics Building was obvious. The authors strongly urge the National Council on Radiation Protection and Measurements to set maximum permissible concentration or guidelines for both public buildings and private homes. (UK)

Radiation Source Calibration and Standardization

Refer also to abstracts 18763, 19266, 19267, and 19288.

19294 SHOULD THE USE OF CURIE, RAD, AND ROENTGEN BE ELIMINATED. Wyckoff, H. O. Excerpta Med. Int. Congr. Ser.; 2: 550-553(1974).

From 13th international congress of radiology; Madrid, Spain (15 Oct 1973).

It is questioned whether the replacement by SI-units of the terms curie, roentgen, rad and rem would be of practical importance. (NL)

19295 BETA EMISSION FROM ENCAPSULATED SOURCES OF ^{252}Cf. Dicello, J. F.; Colvett, R. D.; Gross, W.; Kraljevic, U. (Columbia Univ., New York). Radiat. Res.; 64: No. 2, 401-404(Nov 1975).

Microdosimetric data show that the dose rate in free air for 0.85-mu g afterloading cells of californium-252 with 0.25-mm-thick walls of a platinum-iridium alloy is approximately 40 per cent higher than for 10-mu g applicator tubes with 0.70-mm walls of the same alloy. Although the high LET component of the radiation is in substantial agreement with previous works, the low LET component is approximately twice as large as any previously reported value. Measurements show that the larger dose rate is a result of a substantial amount of beta ray emission which is more strongly absorbed by the thicker walls of the 10-mu g applicator tubes.

19296 ENGINEERING COMPENDIUM ON RADIATION SHIELDING. Volume II. Shielding Materials. Jaeger, R. G. (ed.). New York; Springer-Verlag New York Inc. (1975). 447p. $137.60.

Properties of shielding materials for gamma radiation, including occurrence and extraction, physical properties, fabrication, and applications and design considerations are presented for lead and lead alloys, iron and iron alloys (steel), uranium, tungsten, bismuth, copper, aluminum, soil, ceramics, water, transparent materials (silicate and lead glasses), concretes, and air. Neutron shielding properties are given for lead and lead alloys, iron and iron alloys, uranium, tungsten, bismuth, copper, aluminum, beryllium, graphite, water, organic materials (rubber, plastics, oils, paraffins), wood and compressed wood, metallic and saline hydrides, cadmium and cadmium alloys, boron and boron compounds, boral, boron-graphite, combinations, concretes, and air. Laminated shields are discussed, the effects of heating on the properties of concretes are given, and optimization of the choice of shielding materials is considered. (extensive tables and figures) (GHT)

Shielding Calculations and Experiments

Refer also to abstract 17211

19297 THERAPEUTIC NEUTRON SOURCE. (to Philips Gloeilampenfabrieken N. V.). Netherlands Patent 7,402,505/A/. 25 Feb 1974. 7p. (In Dutch).

A new composition of shields such as those used for neutron sources applied in nuclear medicine is proposed. By combining different materials for the three usual layers, the weight and thickness of the shielding cylinder is reduced and the neutron and gamma ray capture capacity improved. A series of changeable diaphragms to close the beam passage provides greater protection for both personnel and patients. The shielded neutron source is rotatable around the patient table. (NL)

PHYSICS (THEORETICAL)

General

Refer also to abstracts 18428, 18577, 18660, and 18701.

19298 (FRNC-TH-570) IDENTIFICATION PROBLEMS IN LINEAR TRANSFORMATION SYSTEM. Delforge, J. (Paris-11 Univ., 91-Orsay (France)). 1975. 200p. (In French). INIS.

An attempt was made to solve the theoretical and numerical difficulties involved in the identification problem relative to the linear part of P. Delattre's theory of transformation systems. The theoretical difficulties are due to the very important problem of the uniqueness of the solution, which must be demonstrated in order to justify the value of the solution found. Simple criteria have been found when measurements are possible on all the equivalence classes, but the problem remains imperfectly solved when certain evolution curves are unknown. The numerical difficulties are of two kinds: a slow convergence of iterative methods and a strong repercussion of numerical and experimental errors on the solution. In the former case a fast convergence was obtained by transformation of the parametric space, while in the latter it was possible, from sensitivity functions, to estimate the errors, to define and measure the conditioning of the identification problem then to minimize this conditioning as a function of the experimental conditions. (FR)

19299 MEANING AND BOUNDS FOR THE SPACE AND TIME UNCERTAINTY CONTRIBUTIONS. Papp, E. (Polytechnic Inst. of Cluj). Ann. Phys. (Leipzig); 32: No. 4, 285-296(Jun 1975).

The space and time uncertainties are evaluated by using the quantum mechanical space-time description. It is proved that it is not the total uncertainty contribution which has to be interpreted as a whole, but rather the distinct uncertainty contributions which possess a well defined physical meaning. In this sense the space and time uncertainty contributions are analyzed in the context of the binary space-time description. (auth)

19300 QUASIPARTICLE LIFETIMES IN FERMI SYSTEMS. Fennel, W.; Wilfer, H. P. (Univ., Rostock, Ger.). Ann. Phys. (Leipzig); 32: No. 4, 265-276(Jun 1975).

The one-particle spectrum in a homogeneous electron gas at metallic densities ($r_s = 2$) and a wide temperature range is calculated explicitly. Thermodynamic properties of the one-particle spectrum, such as the temperature dependence of the quasiparticle energy and lifetimes, are investigated. (auth)

19301 THEORY OF RESONANT INTERACTION OF WAVE PACKETS IN NONLINEAR MEDIA. Zakharov, V. E.; Manakov, S. V. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1654-1673(Nov 1975). (In Russian)

Resonant (both decay and explosive) interaction between three one-dimensional wave packets in a nondissipative medium is analyzed by the inverse scattering method. An algorithm for setting up exact solutions is indicated, and packet scattering due to resonant decay interaction is studied in detail. (auth)

19302 DOES GOD PLAY DICE. A Discussion of Some Interpretations of Quantum Mechanics. Ross-Bonney, A. A. (Univ. of California, Berkeley). Nuovo Cim.; 30B: No. 1, 55-79(11 Nov 1975).

Three interpretations of quantum mechanics are reexamined: the orthodox or "Copenhagen" interpretation, the expanding worlds interpretation and the interpretation that is generally named statistical. It is concluded that the first two interpretations introduce unnecessary conceptual difficulties, and that it is consequently preferable to accept the statistical interpretation. (auth)

19303 SOME REMARKS ON Φ_+-OPERATORS AND ON THE COINCIDENCE DEGREE FOR A FREDHOLM EQUATION WITH NONCOMPACT NONLINEAR PERTURBATIONS. Hetzer, G. (Univ., Aachen). Ann. Soc. Sci. Brux. Ser. I; 89: No. 4, 497-508 (20 Nov 1975).

If L is a Φ_+-operator with domain and range in Banach spaces X respectively Z, one associates a positive real number 1 to it, such that each of its pseudo-inverses is a 1-set contraction. Hence one receives a stability result for the perturbation of Φ_+-operators by continuous linear maps and a coincidence degree for the equation $Lx = Nx$, where N is a k-set contraction with $0 \leq k < 1$. One obtains as applications some existence theorems, proved by J. Mawhin for completely continuous N. (auth)

19304 SHORT-RANGE CORRELATION ENERGY IN A TWO-DIMENSIONAL ELECTRON GAS. Apostol, M.; Ixaru, I. G. (Inst. for Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 6, 645-651(1975).

The short-range correlation energy in a two-dimensional electron gas is evaluated by means of a perturbational approach. The second-order contributions are numerically computed by a Monte Carlo method of integration. The results are compared with those known for the three-dimensional electron gas. (auth)

19305 ALTERNATIVES TO THE DIRAC EQUATION. Girvin, S.M.; Brownstein, K.R. (Department of Physics and Astronomy, University of Maine, Orono, Maine 04473). Phys. Rev. D 12: No. 8, 2337-2343 (15 Oct 1975).

Recent work by Biedenharn, Han, and van Dam (BHvD) has questioned the uniqueness of the Dirac equation. BHvD have obtained a two-component equation as an alternate to the Dirac equation. Although they later show their alternative to be unitarily equivalent to the Dirac equation, certain physical differences were claimed. BHvD attribute the existence of this alternate equation to the fact that their factorizing matrices were position-dependent. To investigate this, we factor the Klein-Gordon equation in spherical coordinates allowing the factorizing matrices to depend arbitrarily upon θ and ϕ. It is shown that despite this additional freedom, and without involving any relativistic covariance, the conventional four-component Dirac equation is the only possibility. (auth)

Quantum Field Theories

Refer also to abstracts 18547, 18572, 18654, 18684, and 19205.

19306 (CNRS-CPT-75-P-723) RENORMALIZATION OF GAUGE THEORIES. Becchi, C.; Rouet, A.; Stora, R. (Centre National de la Recherche Scientifique, 13-Marseille (France). Centre de Physique Theorique). Apr 1975. 57p. INIS.

Gauge theories are characterized by the Slavnov identities which express their invariance under a family of transformations of the supergauge type which involve the Faddeev Popov ghosts. These identities are proved to all orders of renormalized perturbation theory, within the BPHZ framework, when the underlying Lie algebra is semi-simple and the gauge function is chosen to be linear in the fields in such a way that all fields are massive. An example, the SU2 Higgs Kibble model is analyzed in detail: the asymptotic theory is formulated in the perturbative sense, and shown to be reasonable, namely, the physical S operator is unitary and independent from the parameters which define the gauge function. (FR)

19307 (PP-452) COMMENTS ABOUT THE ARTICLE BY FLEURY AND LEITE-LOPES ON TACHYONS AND CAUSALITY. Recami, E. (Catania Univ. (Italy). Instituto di Fisica Teorica). Dec 1975. 14p. Dep. NTIS (US Sales Only) $3.50.

Some comments are put forth on a previous paper on the causality problem for tachyons. (JFP)

19308 APPLICATION OF GAUGE FIELD THEORY TO CLASSICAL MECHANICS. Calvini, P. (Istituto di Scienze Fisiche dell'Universita, Genova, Italy). Lett. Nuovo Cim.; 13: No. 18, 669-672(30 Aug 1975).

An application is shown for a previous new method introduced to derive some kinds of interaction and that gravity can be considered as the gauge field associated with space-time symmetries. The case considered is a very simple one where the meaning of the gauge transformations (1st and 2nd kind) and fields is straightforward. One deals with classical mechanics. The hypothesis is made of a closed mechanical system (only interactions among its particles are allowed) in an isotropic and homogeneous space. A classical system of N pointlike particles described by a Lagrangian function is considered. (JFP)

19309 FURTHER COMMENTS ON CONFORMAL SYMMETRY IN THE WEYL THEORY. Berger, S. B. (Massachusetts Inst. of Tech., Cambridge). Lett. Nuovo Cim.; 14: No. 8, 265-266 (25 Oct 1975).

The choice of the physical momentum operator written in terms of Dirac matrices in a given form is defended in view of the objection that the components of this operator do not commute. (JFP)

19310 QUANTUM ELECTRODYNAMICS IN LASER FIELDS. Mitter, H. (Univ., Tuebingen, Ger.). Acta Phys. Austriaca, Suppl.; 14: 397-468(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

The discussion of quantum electrodynamics in laser fields includes the description of the laser field, the Volkov solution, the propagator, Feynman diagrams, simple processes, higher-order processes, and radiative corrections. (JFP)

19311 VACUUM POLARIZATION, SOURCE- AND OTHERWISE. Dittrich, W. (Univ., Tuebingen, Ger.). Acta Phys. Austriaca, Suppl.; 14: 489-520(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

The topics discussed include vacuum polarization and gauge invariance, and modified photon propagation function $\bar{D}_{\ddagger}$. (JFP)

19312 SPONTANEOUS MASS GENERATION, RENORMALIZATION GROUP, AND SOLVABLE U(N)-SYMMETRIC MODELS. Roemer, H. (Univ., Bonn). Acta Phys. Austriaca, Suppl.; 14: 521-548(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

The notion of spontaneous mass generation is defined, and some remarks are made about mass generation and effective potential. Then the rule is stated that spontaneous mass generation should be impossible, if the value of the coupling constant lies between two zeros of the coefficient function β. This rule is confirmed in several U(N)-symmetric models, which in the limit $N \to \infty$ are solvable. A U(N)-symmetric 0^4-theory for space - time dimension $D = 4 - \epsilon$ for which β has an ultraviolet stable zero at the origin and a positive infrared stable zero of order ϵ are used as illustrations. (JFP)

19313 SECOND LOOK AT RELATIVISTIC WAVE EQUATIONS. Biritz, H. (Georgia Inst. of Tech., Atlanta). Acta Phys. Austriaca, Suppl.; 14: 549-565(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

The first explicit calculations with finite-component, manifestly covariant wave equations of the form $(-1\ \beta^j\partial_j + 1\psi\ (x) = 0$ are given. Results for the mass spectra and parities of such general wave equations, the magnetic moments for minimal coupling, and the renormalization of the axial-vector coupling constant are presented. (JFP)

19314 STRUCTURAL QUESTIONS IN QUANTUM FIELD THEORY. Haag, R. (DESY, Hamburg). Acta Phys. Austriaca, Suppl.; 14: 567-580(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

Conceptual structure in quantum field theory is described in the most economical language incorporating the principles of special relativity and quantum physics. A mathematical account of C^* algebra, the use of C^* algebra in quantum physics in general, and the adaptation to local relativistic quantum physics are treated. The type of question for which this point of view is more appropriate than the Hilbert space version is pointed out. (JFP)

19315 STOCHASTIC PROCESSES AND QUANTUM THEORY. Klauder, J. R. (Bell Telephone Labs., Murray Hill, NJ). Acta Phys. Austriaca, Suppl.; 14: 581-629(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

The quantum theory for a variety of stochastic processes, namely, real time diffusion phenomena, which are analogues of imaginary time quantum theory for certain examples and also analogues of covariant imaginary time quantum field theory, is considered. Some standard properties involving probability measures and stochastic variables, a simple class of examples that includes one of the clearest cases of a discontinuous perturbation are treated. Finally, a development is given for the fact that certain stochastic theories actually exhibit divergences that simulate those of covariant quantum field theory and examples of both renormalizable and nonrenormalizable behavior are presented, one of which is completely solved. (JFP)

19316 FINITE CONFORMAL TRANSFORMATIONS IN LOCAL QUANTUM FIELD THEORY. Ruehl, W. (Univ., Kaiserslautern, Ger.). Acta Phys. Austriaca, Suppl.; 14: 643-666(1975).

From electromagnetic interactions and field theory proceedings of the 14th international university week for nuclear physics; Schaldming, Austria (24 Feb 1975). See CONF-750244-.

It is known that the solution for reconciling locality with conformal invariance can be formulated either by replacing the ansatz for the scalar field operator by a nonlocal transformation formula or introducing quantum fields on an extended Minkowski space. It is shown that both approaches are equivalent for the case of the Thirring model. (JFP)

19317 SPECIAL RELATIVITY. Taylor, J. G. Oxford; Clarendon Press (1975). 106p.

Special relativity is reviewed from an elementary mathematical viewpoint, and includes discussion of recent experiments which set out to test Einstein's predictions. The theory of relativity is then reformulated in more sophisticated mathematical language to show its relation to electromagnetism, and to lay the foundation for more general viewpoints. A discussion is given in simple terms of where activity in the field is currently centered, and where future interest lies. Included are: the constant speed of light; measuring time and distance; the Lorentz transformation (relativity of simultaneity, space-time and causality); relativistic kinematics (including--the Doppler effect); relativistic dynamics (including--nuclear binding energy, particle creation, electrodynamics); the structure of special relativity (including--the Lorentz group, the rotation group, elementary particle scattering); extensions of special relativity. (UK)

19318 OBSERVABLES AND TRANSFORMATION PROPERTIES OF FERMIONS AND PARAFERMIONS CONSTRUCTED IN TERMS OF BOSONS. I. The Physical Variables. Kalnay, A. J. (Istituto Venezolanano de Investigaciones Cientificas, Caracas); Kademova, K. V. Int. J. Theor. Phys.; 12: No. 2, 141-143(Feb 1975).

It was previously reported (Kalnay, MacCotrina and Kademova. Int. J. Theor. Phys.; 7: 9 (1973)) that the quantum Fermi or para-Fermi commutation rules of fields could be reproduced in terms of functions of Bose fields; the same concepts are utilized for the Bose representation of physical variables. (UK)

19319 OBSERVABLES AND TRANSFORMATION PROPERTIES OF FERMIONS AND PARAFERMIONS CONSTRUCTED IN TERMS OF BOSONS. II. Transformation Law. Kalnay, A. J. (Istituto Venezolanano de Investigaciones Cientificas, Caracas); Kademova, K. V. Int. J. Theor. Phys.; 12: No. 2, 145-147(Feb 1975).

It was previously reported (Kalnay, MacCotrina and Kademova. Int. J. Theor. Phys.; 7: 9 (1973)) that the quantum Fermi or para-Fermi commutation rules of fields could be reproduced in terms of functions of Bose fields, and (Kalnay and Kademova. Int. J. Theor. Phys.; 12: 141 (1975)), the same concepts are utilized for the Bose representation of transformation laws. It is apparent that the Bose representation does not introduce conflict between the tensor transformation laws of bosons and the spinor laws of fermions and parafermions. (UK)

19320 ASYMPTOTICALLY FREE MODELS WITH MASSIVE VECTOR FIELDS. Fradkin, E. S.; Kalashnikov, O. K. (Inst. of Theoretical Physics, Moscow). J. Phys., A (London); 8: No. 11, 1814-1818(Nov 1975).

Asymptotically free models with massive vector fields are constructed within the SU(2) group. Physical consequences of such models are briefly discussed. (auth)

19321 ALTERNATIVE CLASS OF SUPERSYMMETRIES. Keck, B. W. (Southampton Univ., Eng.). J. Phys., A (London); 8: No. 11, 1819-1827(Nov 1975).

The supersymmetry of Wess and Zumino (Nucl. Phys.; B70: 39 (1974)) is generalized to square roots of a class of ordinary Lie groups. The case of $0_{2,3}$ is studied in detail. Supersymmetric equations of motion for fields on a variant of de-Sitter space are obtained. The only dimensional parameter is the radius of space-time. (auth)

19322 BEHAVIOR OF THE FUNCTION $Z_3(\alpha)$ IN SECOND CLASS QED. Jouvet, B. (Paris Univ., Orsay, France); Bordes, G. Nuovo Cim., 28A: No. 3, 273-288(1 Aug 1975).

Using the renormalization group representation of the 2nd-class photon propagators, the properties of the function $Z_3(\alpha)$ near the two limits $\alpha \to \alpha_c$, such that $Z_3(\alpha_c) = 0$, and $\alpha \to 0$ are studied. This reveals the physical importance that a determination of the type of the singularity of $Z_3(\alpha)$ at the last limit might have. (auth)

19323 ALGEBRAIC CONSTRUCTION OF THE SCALE-INVARIANT ASYMPTOTIC THEORY. I. General Formulation. Gatto, R. (Univ., Rome); Sartori, G. Nuovo Cim., 30A: No. 3, 430-452(1 Dec 1975).

The algebraic construction of the scale-invariant asymptotic theory corresponding to a theory which possesses the property of softly broken scale (and, possibly, also conformal) invariance is derived. The construction is obtained by performing a «contraction» on the charges and local fields of the full theory. (auth)

19324 ALGEBRAIC CONSTRUCTION OF THE SCALE-INVARIANT ASYMPTOTIC THEORY. II. Application to Massive

Free Fields. Gatto, R. (Univ., Rome); Sartori, G. Nuovo Cim., 30A: No. 3, 453-482(1 Dec 1975).

The procedures proposed previously to construct the asymptotic scale-invariant theory is applied to massive free fields. The contracted fields (of the asymptotic theory) are calculated in terms of the original fields by two different procedures. The contracted charges are calculated and their general relation to the original charges is verified. The problem of defining a vacuum state for the contracted fields and charges is solved. The relation to the problem of non-equivalent representations of the commutator relations is pointed out. (auth)

19325 QUANTUM FIELDS IN CURVED SPACE-TIMES. Ashtekar, A. (Oxford Univ.); Magnon, A. Proc. R. Soc. (London), Ser. A; 346: No. 1646, 375-394(4 Nov 1975).

The problem of obtaining a quantum description of the (real) Klein–Gordon system in a given curved space-time is discussed. An algebraic approach is used. The *-algebra of quantum operators is constructed explicitly and the problem of finding its *-representation is reduced to that of selecting a suitable complex structure on the real vector space of the solutions of the (classical) Klein-Gordon equation. Since, in a static space-time, there already exists, a satisfactory quantum field theory, in this case one already knows what the "correct" complex structure is. A physical characterization of this "correct" complex structure is obtained. This characterization is used to extend quantum field theory to nonstatic space-times. Stationary space-times are considered first. In this case, the issue of extension is completely straightforward and the resulting theory is the natural generalization of the one in static space-times. General, nonstationary space-times are then considered. In this case the issue of extension is quite complicated and only a plausible extension is presented. Although the resulting framework is well defined mathematically, the physical interpretation associated with it is rather unconventional. Merits and weaknesses of this framework are discussed. (auth)

19326 NEW INTERPRETATION OF THE SPECIAL THEORY OF RELATIVITY. Buonomano, V. (Univ. Estadual de Campinos, Brazil). Int. J. Theor. Phys.; 13: No. 4, 213-226(Jul 1975).

Assuming the "big bang" theory as well as the usual axioms in the special theory of relativity, the time dilations and length contractions are treated as real physical effects. This becomes possible by relating everything to the hypothetical frame, S_a, at rest relative to the "big bang" event. This frame in many senses plays the role of the classical aether frame. A clock's real rhythm, as opposed to its rhythm observed by restricted methods, is then a function of its velocity relative to S_a (assuming a uniform gravitational field). It is further assumed that gravitational radiation is composed of "electromagnetic-like" waves. Therefore when a clock changes its velocity in a uniform gravitational field it must receive a different total energy due to the average frequency shift (Doppler effect), the time dilations are then caused by the change in energy due to this frequency shift. That is, no two clocks can be in the "same" gravitational field unless they have no relative velocity, and therefore the special theory of relativity is a special case of the general theory from this viewpoint. Two feasible experimental tests, using the Moessbauer effect, are described that would decide on these viewpoints. The principle of equivalence and the "twin paradox" are also discussed. (auth)

19327 QUANTIZATION OF A SCALAR FIELD IN THE KERR SPACETIME. Ford, L. H. Princeton, NJ; Princeton Univ. (1974). 124p. University Microfilms Order No. 75-20,632.

Thesis (Ph. D.).

A discussion of field quantization in a curved background spacetime is presented, with emphasis on the quantization of a scalar field in the Kerr spacetime. The ambiguity in the choice of a Fock space is discussed. The example of quantized fields in a rotating frame of reference in Minkowski space is analyzed, and it is shown that there is a preferred choice of states which makes particle number an invariant under transformation to the rotating frame. This choice allows the existence of negative energy quanta of the field. (JFP)

19328 QUANTUM MECHANICAL APPROXIMATIONS IN QUANTUM FIELD THEORY. Jackiw, R. (Massachusetts Inst. of Tech., Cambridge). pp 371-409 of Theories and Experiments in High-Energy Physics. Kursunoglu, B. (ed.). New York; Plenum Publishing Corp. ([nd]).

A lecture is given reviewing the extension of quantum mechanical approximations to quantum field theory. The coverage includes the variational principle, Rayleigh–Ritz variation, effective action, loop expansion, semi-classical and Hartree–Fock approximations, symmetry behavior at zero and finite temperatures, position-dependent solutions, the Kerman–Klein method, bound state baryons, and dynamical symmetry breaking. (JFP)

19329 INFRARED PROBLEMS IN QUANTUM ELECTRODYNAMICS. Papanicolaou, N. New York; New York Univ. (1975). 166p. University Microfilms Order No. 75-28,577.

Thesis (Ph. D.).

The traditional Green functions approach is adopted for the discussion of a self-contained treatment of the infrared problems in quantum electrodynamics. The program includes a derivation and explicit proof of finiteness of a modified reduction formula for scattering in nonrelativistic potentials, where the Green function is known is closed form, proof of finiteness to all orders in the potential for the relativistic case on the basis of asymptotic Green functions, constructed explicitly, and unitary extensions of the relativistic Coulomb amplitudes in the forward direction, which shows a nonintegrable singularity due to the long-range nature of the potential. As an application of these methods the scattering amplitude for massless test particles in a Schwarzschild field is derived in the weak field limit confirming the known classical result. Scattering theory in quantum electrodynamics is elaborated in the context of the coherent states formulation of the asymptotic condition. Dimensional regularization techniques are systematically used for the reduction of coherent states and the explicit construction of S-matrix elements and cross sections. The infrared factorization is obtained in a space-time dimension n greater than 4, where the Green functions are normalized on-mass-shell. On the basis of this factorization, a formal proof of finiteness of the reduction formula to all orders in perturbation theory is presented. Various illustrating examples are worked out, in particular muon decay, where a precise theoretical explanation of the radiation damping at the end-point of the spectrum is given in the context of the formalism. (Diss. Abstr. Int., B)

19330 LAGRANGE FUNCTION OF AN INTENSE ELECTROMAGNETIC FIELD AND QUANTUM ELECTRODYNAMICS AT SMALL DISTANCES. Ritus, V. I. (Lebedev Inst. of Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 5, 1517-1536(Nov 1975). (In Russian)

A nonlinear correction to the Lagrange function of constant electromagnetic field is found which follows after the Heisenberg-Euler correction and takes into account alteration of radiative interaction of vacuum electrons by the external field. In perturbation theory with respect to radiation field, the field Lagrange function can be described by a much smaller number of diagrams than the photon polarization function; however, in the strong-field limit it possesses the same amount of information as the latter does in the limit of large values of the squared momenta. The Lagrange function thus becomes interesting not only in the electrodynamics of intense fields but also in the electrodynamics at small distances. Not only the charge but the mass of a real electron as well is determined by the behavior of the field Lagrange function. An improved perturbation theory series and its applicability parameter can be found for the asymptotic strong field Lagrange function by taking into account invariance with respect to the renormalization group. For an exponentially strong field this series diverges, the lower approximation to the Lagrange function being zero. (auth)

19331 SUPERSYMMETRIC STUECKELBERG FORMALISM. Delbourgo, R. (Imperial College of Science and Tech., London). J. Phys., G (London); 1: No. 8, 800-804(21 Oct 1975).

The theory of a massive abelian supersymmetric vector field interacting with a "conserved source" is re-expressed in the Stueckelberg formalism and thereby shown to be renormalizable. (auth)

19332 BETHE–SALPETER EQUATION IN SUPERFIELD THEORY. Delbourgo, R.; Jarvis, P. (Imperial College of Science and Tech., London). J. Phys., G. (London); 1: No. 8, 791-799(21 Oct 1975).

A study of the supersymmetric analog of the Wick-Cutkosky (Wick. Phys. Rev.; 96: 1124 (1954) and Cutkosky. Phys. Rev.; 96: 1135 (1954)) model shows that the system resembles more closely the Goldstein model for a fermion-antifermion composite. The eigenvalue problem for the $p = 0$ superstates is solved and the more difficult case of $p^2 > 0$ is discussed. (auth)

19333 PRINCIPLE OF MINIMAL SINGULARITY. Kharatyan, S. G. (Inst. of Mathematics, Novosibirsk, USSR). Izv. Akad. Nauk Arm. SSR, Ser. Fiz.; 10: No. 3, 217-219(1975). (In Russian).

Different members of Borchers' class are shown to satisfy different equal time commutation relations whence follows that the principle of minimal singularity is independent as regards Lemann–Symanzik–Zimmerman axioms. It is also shown that the considered members of Borchers' class don't correspond to the unitary extrapolation beyond the mass shell. (auth)

19334 CONTRIBUTION TO THE THEORY OF QUANTUM PROCESSES IN THE FIELD, OF AN INTENSE ELECTROMAGNETIC WAVE. Baier, V. N.; Katkov, V. M.; Mil'shtein, A. I.; Strakhovenko, V. M. (Inst. of Nuclear Physics, Novosibirsk,

USSR). Zh. Eksp. Teor. Fiz.; 69: No. 3, 783-799(Sep 1975). (In Russian).

The operator diagram technique which was previously developed for phenomena in a homogeneous external field is applied to processes taking place in the field of a plane electromagnetic wave. Underlying the calculation method is the specific technique of disentangling of the operator expressions. A mass operator is found for scalar and spinor particles in the field of an elliptically polarized wave of a general form prescribed by a double integral. The imaginary part yields a new representation of the total probability for particle emission in the wave field. An analysis of polarized effects is presented for spinor particles. (auth)

19335 RECURSION EQUATIONS IN GAUGE FIELD THEORIES. Migdal, A. A. (Inst. of Theoretical Physics, Moscow). Zh. Eksp. Teor. Fiz.; 69: No. 3, 810-822(Sep 1975). (In Russian).

An approximate recursion equation is formulated which describes scale transformation of the effective action of a gauge field. The equation becomes exact in 2-dimensional space-time. In 4-dimensional theory it reproduces asymptotic freedom with an accuracy to 30% in the β-function coefficients. The β-function remains negative in the strong coupling domain and this results in an asymptotic prison in the infrared region. Possible extensions and applications to color quark-gluon gauge theory are discussed. (auth)

19336 ISOMERIC STATES OF QUANTUM FIELDS. Polyakov, A. M. (Inst. of Theoretical and Experimental Physics, Moscow). Zh. Eksp. Teor. Fiz.; 68: No. 6, 1975-1990(Jun 1975). (In Russian).

It is shown that in theories with spontaneously broken gauge symmetry there exist particles of a special type which are classical field blobs with small quantum fluctuations. Such blobs can exist only if the state of the field at arbitrarily large distances from the blob cannot be continuously deformed in ordinary vacuum. Because of this the isomers under consideration possess exactly conserved quantum numbers, called topological, which were not present in the initial Lagrangian. The problem of identifying the isomers with observable particles is discussed. (auth)

19337 SUPERSYMMETRICAL RENORMALIZABLE THEORY OF MASSIVE VECTOR NON-ABELIAN FIELD. Likhtman, E.P. (P.N. Lebedev Physics Institute, USSR Academy of Sciences). JETP Lett. 22: No. 2, 57-58 (20 July 1975).

A supersymmetrical model is considered, which is invariant also with respect to global $U(1) \otimes SU(n)$ transformations. The model describes renormalizable interactions of scalar, spinor, and vector fields, the masses of all fields being the same. (auth)

19338 HIGGS–KIBBLE MECHANISM FOR A SPIN-2 GAUGE FIELD. Tchrakian, D. H.; O'Sullivan, P. (Saint Patrick's Coll., Maynooth (Ireland)). Phys. Lett., B; 59: No. 2, 150-152(27 Oct 1975).

The Higgs–Kibble mechanism is applied to an SL(2,C) gauge Lagrangian with a spin-one matter field and a spin-2 gauge field. It is found that desirable results are obtained by allowing the matter field to be a massive multiplet consisting of a left-handed and a right-handed particle. (NL)

19339 QUANTUM DESCRIPTION OF A TWISTABLE STRING AND THE NEVEU–SCHWARZ–RAMOND MODEL. Kraemmer, A. B.; Nielsen, H. B. (Niels Bohr Institutet, Copenhagen (Denmark)). Nucl. Phys., B; 98: No. 1, 29-48(27 Oct 1975).

A quantum description is developed of a twistable string, and it is shown that it can be described in terms of Fermi fields having Thirring model interactions. Regularized solutions for the twisting string can then be obtained from the known solutions to the Thirring model. It is also argued that the interpretation of the Neveu–Schwarz and Ramond models in terms of the X-Y model for an antiferromagnetic chain is just a special case of the string interpretation. In fact a twisting stick with moment of inertia density $1/\pi$ (when the speed of torsional sound and $h/2\pi$ are units) coincides in the long-wavelength limit with the X-Y model, and it may thus be speculated that it is a physical model for the dual fermion model. (NL)

19340 GAUGE INVARIANCE AND BROKEN CONFORMAL SYMMETRY. Nielsen, N. K. (Aarhus Univ. (Denmark)). Nucl. Phys., B; 97: No. 3, 527-540(20 Oct 1975).

It is demonstrated that conformal symmetry also in non-Abelian gauge theories is broken in the same way as scale invariance, if only Green functions and vertex functions of exclusively gauge-invariant operators are considered. In the course of the derivation, a simple rule is obtained for the determination of the gauge dependence of renormalization constants, and possible clues to an understanding of the properties of physical states are found. (NL)

19341 CONTRIBUTION OF QUANTUM ELECTRODYNAMICS TO THE ANOMALY OF THE MUON. Calmet, J.; Peterman, A. (European Organization for Nuclear Research, Geneva (Switzerland)). Phys. Lett., B; 58: No. 4, 449(29 Sep 1975).

Quantum electrodynamics contributions to the anomalous magnetic moment of the muon are summarized using the latest available theoretical results. At sixth order they amount to $(a_\mu - a_e^{(4)})_{QED} = (21.73 \pm 0.16)(\alpha/\pi)^3$. (NL)

19342 NON-PERTURBATIVE SEMI-CLASSICAL METHODS IN QUANTUM FIELD THEORY (A PEDAGOGICAL REVIEW). Rajaraman, R. (Institute for Advanced Study, Princeton, N. J. (USA)). Phys. Rep.; 21: No. 5, 227-313(Oct 1975).

60 refs.

A pedagogical introduction is given to non-perturbative semi-classical methods for finding solutions to quantum theories. Both the weak coupling method, based on a time-dependent classical solution, and the WKB method based on all periodic orbits are developed in detail, proceeding from elementary quantum mechanics to field theory in stages. Both methods are then illustrated in model field theories. The $[\lambda\phi^4]_2$ theory to which weak coupling is applied yields a new family of kink states whose properties are discussed. (NL)

19343 SUBTRACTED MANDELSTAM REPRESENTATION IN THE HIGGS MODEL. Yoshikawa, K. (Scuola Normale Superiore, Pisa (Italy)). Nucl. Phys., B; 98: No. 3, 533-546(10 Nov 1975).

The subtracted Mandelstam representation is presented for the Higgs model. Two subtractions are required for the double dispersion integrals, and one subtraction is required for the single dispersion integrals. A special and simple form of subtraction for the double dispersion integral is adopted, and there remains no arbitrary parameter except the coupling constant. High-energy behaviors are carefully investigated for both absorptive and dispersive parts and in general configurations of elastic scattering. (NL)

19344 NEW METHODS FOR SOLVING THE BETHE-GOLDSTONE EQUATION. Znojil, M. (Institute of Nuclear Physics, Czechoslovak Academy of Science, CS 250 68 Řež, Czechoslovakia). Phys. Rev. C 12: No. 6, 2077-2083 (Dec 1975).

Two methods of calculation of the Brueckner correlated wave function are suggested for the Bethe-Goldstone equation defined with the propagator $Q/(\omega + QTQ)$. The first method generalizes the Goldhammer-Pintar approach and is applicable when the energy denominators of the reference and exact propagators are different. The difference is treated as a perturbation. The second method consists in a direct inclusion of a harmonic Pauli projector. The only approximation is an arbitrary energy cutoff $\bar{N}$ in the oscillator basis. Equations to be solved are written for partial waves. They are integral equations similar to the Schrödinger equation plus a set of linear algebraic equations. They are solved for a separable potential and transformed into differential ones in the case of a local potential. The number of equations is given and the error is *a priori* estimated using qualitative arguments. (auth)

19345 GAUGE-FREE QUANTIZATION OF MASSLESS BOSON FIELDS. Dennis, P.W. (Physics Department, University of Missouri—Columbia, Columbia, Missouri 65201). Phys. Rev. D 12: No. 8, 2237-2243 (15 Oct 1975).

A gauge-independent quantization procedure is developed for arbitrary-spin, massless boson fields. The general spin-S wave equation is analyzed in the spin-coefficient formalism. The constraint problem is then found to be trivial, and all the field variables are expessed in terms of one complex field. Canonical quantization of this field is carried through, and conserved quantities are constructed. The formalism leads to a new expression for the energy density of a gravitational field. (auth)

19346 EXACT LOCALIZED SOLUTIONS OF TWO-DIMENSIONAL FIELD THEORIES OF MASSIVE FERMIONS WITH FERMI INTERACTIONS. Lee, S.Y.; Kuo, T.K.; Gavrielides, A. (Department of Physics, Purdue University, West Lafayette, Indiana 47907). Phys. Rev. D 12: No. 8, 2249-2253 (15 Oct 1975).

The classical equations of motion for field theories of massive fermions with Fermi interactions in one space and one time dimension are investigated. It is shown that they all possess exact stationary solutions which are localized, due to the vanishing of the stress tensor, a feature for this type of solutions only in two dimensions. The explicit forms of these solutions are presented. More importantly, exact solutions for the bound state of N localized massive fermions with scalar or vector Fermi interactions are also found. (auth)

19347 SPONTANEOUS SYMMETRY BREAKING IN O(N)-SYMMETRIC ϕ^6 THEORY IN THE $1/N$ EXPANSION. Townsend, P.K. (Department of Physics, Brandeis University, Waltham, Massachusetts 02154). Phys. Rev. D 12: No. 8, 2269-2285 (15 Oct 1975).

An O(N)-symmetric scalar field theory with ϕ^4 and ϕ^6 coupling is

considered to leading order in the $1/N$ expansion for one, two, and three space-time dimensions. The effective potential is derived and conditions for spontaneous symmetry breaking studied. In one and two dimensions symmetry breaking is impossible. In three dimensions symmetry breaking can occur, and the vacuum expectation values of the fields are given by the tree-approximation result for an appropriate choice of renormalized parameters. There are possible first- and second-order transitions to an $O(N)$-asymmetric vacuum and a tricritical point. Critical behavior is not discussed in detail in this paper, however. A technique is introduced which allows the derivation of all the Green's functions of the theory to leading order in $1/N$. The propagators in the asymmetric vacuum are derived and found to be well behaved and, in three dimensions, qualitatively similar to $\lambda\phi^4$ theory. These conclusions are checked by independent methods, verifying to leading order the consistency of the $1/N$ expansion for this model. (auth)

19348 COMBINED SUPERSYMMETRIC AND GAUGE-INVARIANT FIELD THEORIES. de Wit, B.; Freedman, D.Z. (Institute for Theoretical Physics, State University of New York at Stony Brook, Stony Brook, New York 11794). Phys. Rev. D 12: No. 8, 2286-2297 (15 Oct 1975).

The combined supersymmetric and gauge-invariant field theories are formulated using ordinary fields, not superfields, from the start, thereby eliminating reference to superfluous components. The construction is a generalization to supersymmetry of the minimal-coupling procedure of ordinary gauge theories. The Lagrangians obtained coincide with those of the superfield approach in the Wess-Zumino gauge. The Ward-Takahashi identities of Green's functions for fields and supersymmetry currents are obtained by functional methods. The Ward-Takahashi identities are presented in a form from which low-energy theorems for Goldstone fermions can be directly derived, and the proof of the Goldstone theorem in these combined theories is clarified. Discussion of the closure of the supersymmetry algebra leads to the concept of gauge-invariant translations for which the conserved current is a gravitational energy-momentum tensor. Some of the results are valid in a broader context than supersymmetry and are applicable to gauge theories in general. (auth)

19349 SOLUTIONS OF THE CALLAN-SYMANZIK EQUATION IN A COMPLEX NEIGHBORHOOD OF ZERO COUPLING. Khuri, N.N. (Rockefeller University, New York, New York 10021). Phys. Rev. D 12: No. 8, 2298-2310 (15 Oct 1975).

In this paper we investigate some of the consequences of having the vertex functions in a field theory or a model, that satisfy the Callan-Symanzik equation, also satisfy some analyticity and uniformity properties in the coupling constant g. The solutions of the Callan-Symanzik equation in a complex neighborhood of the origin are studied. The implications of analyticity in g to scaling, anomalous dimensions, and Borel summability for large Euclidean momenta are pointed out. The input we start with, though not yet established in four-dimensional field theories, has been proved for two-dimensional ϕ^4 theories. It also happens to be true in many "models" discussed in the literature in connection with Bjorken scaling. (auth)

19350 ELECTRODYNAMICS AND SOURCE MODELS. Phares, A.J. (National Council for Scientific Research, Beirut, Lebanon). Phys. Rev. D 12: No. 8, 2356-2362 (15 Oct 1975).

The study carried out by Schwinger on the modified propagation functions of spin-0 and spin-1/2 particles and their source-model dependence is extended to spin-1 particles. The infrared and ultraviolet behaviors of spectral forms in connection with source models are also discussed. Furthermore, the expected rate of falloff, faster than $1/p^2$, of the propagation function is shown to be source-model independent. (auth)

19351 MASS INDEPENDENCE OF CRITICAL EXPONENTS IN PERTURBATION THEORY. Shapiro, J.A.; Wong, T.F. (Department of Physics, Rutgers, The State University, New Brunswick, New Jersey 08903). Phys. Rev. D 12: No. 8, 2390-2393 (15 Oct 1975).

The suggestion of Dash and Harrington that the critical exponent γ at the fixed point may be found in perturbation theory by its independence of the mass is investigated in the Reggeon calculus and in ϕ^4 theory in three dimensions $[(\phi^4)_3]$. We discuss an ambiguity due to the choice of energy scale and find an invariant criterion for determining the point of mass independence. Neither the Reggeon calculus nor $(\phi^4)_3$ satisfies this criterion, and no natural choice of energy scale works for $(\phi^4)_3$ in second order. (auth)

19352 SPONTANEOUSLY BROKEN ABELIAN-GAUGE-INVARIANT SUPERSYMMETRIC MODEL. Mainland, G.B.; Tanaka, K. (Department of Physics, The Ohio State University, Columbus, Ohio 43210). Phys. Rev. D 12: No. 8, 2394-2396 (15 Oct 1975).

We present a model that is invariant under an Abelian gauge transformation and a modified supersymmetry transformation. This model is broken spontaneously and the interplay between symmetry breaking, Goldstone particles, and mass breaking is studied. In the present model, spontaneously breaking the Abelian symmetry of the vacuum restores the invariance of the vacuum under a modified supersymmetry transformation. (auth)

19353 FIELD-THEORETIC LAGRANGIAN WITH BAGLIKE SOLUTIONS. Chodos, A. (Laboratory for Nuclear Science and Department of Physics, Massachusetts Institute of Technology, Cambridge, Massachusetts 02139). Phys. Rev. D 12: No. 8, 2397-2406 (15 Oct 1975).

A local Lagrangian involving self-coupled charged scalar fields is studied. The theory exhibits classical confined solutions which coincide with solutions of the analogous MIT bag model, even though no reference is made to a specific region of space in formulating the theory, and no auxiliary fields are used to generate the confining potential. Some of the quantum aspects of the theory are explored by means of a variational calculation, and it is shown that the trial wave functional which is used gives rise to the same form for the energy as is obtained in the cavity approximation to the bag model. (auth)

19354 NON-ABELIAN GAUGE THEORIES AND ASYMPTOTIC FREEDOM. Wilczek, F. A. Princeton, NJ; Princeton Univ. (1974). 70p. University Microfilms Order No. 75-20,674.

Thesis (Ph. D.).

The phenomenon of asymptotic freedom may provide an important clue concerning the dynamics of the strong interactions. It was made plausible that if scaling as observed in leptoproduction experiments at SLAC and NAL is a truly asymptotic phenomenon, then the strong interactions must be governed by the exchange of vector gluons corresponding to a non-Abelian group. Applications were made to the study of leptoproduction in the Bjorken limit and many other processes. In the following several topics are presented, for which asymptotic freedom allows one to make interesting statements about quantum field theories, and possibly also about physical reality. One briefly reviews the definition of asymptotic freedom and presents the simplest asymptotically free theories, those with one dimensionless coupling constant. These are the theories with fermions coupled to a simple non-abelian gauge field. The external field problem (constant external field at the one-loop level) for Yang-Mills theory is taken. A general method for solving this problem is presented, and the propagator is worked out in a variety of gauges. A simple form for the effective Lagrangian results in a specially chosen gauge. The effective Lagrangian obeys a renormalization group equation, and asymptotic freedom allows one to construct a good approximation for strong external fields. One also digresses to point out some interesting properties of the electrodynamics of spin-1 particles in renormalizable theories. One discusses how corrections to sum rules may be calculated in asymptotically free theories and presents the most interesting case of corrections to the Callan-Gross sum rule. (Diss. Abstr. Int., B)

19355 SOME EXPERIMENTAL CONSEQUENCES OF ASYMPTOTICALLY FREE FIELD THEORIES. Calvo, M. O. Princeton, NJ; Princeton Univ. (1974). 95p. University Microfilms Order No. 75-20,619.

Thesis (Ph. D.).

Several experimental consequences of non-Abelian asymptotically free gauge theories are studied, in particular, second order corrections to the moments of the nonsinglet pieces of the structure functions are calculated. These results are then used to derive corrections to sum rules as well as to obtain direct functional relations between the structure functions. It is found that, in general, the second order corrections involve calculable and uncalculable constants, but the latter can be either estimated or eliminated by considering suitable combinations of structure functions. It is also shown that some of the correction terms increase as one considers higher moments. This remarkable fact, which is likely to persist in higher orders, suggests that all the functional relations that are derived will have questionable validity near threshold; however, away from this region, where higher order corrections are negligible, all these relations will provide an important test of these theories. Finally, it is shown that no similar predictions can be derived for the singlet pieces of the structure functions, since they always involve uncalculable constants. (Diss. Abstr. Int., B)

Gravitation and General Relativity

Refer also to abstracts 17998, 18585, 19308, and 19345.

19356 TIME-LIKE GEODESICS IN THE FIRST TOMIMATSU-SATO METRIC. Alonso, J. D. (Observatoire de Paris). J. Phys., A (London); 8: No. 11, 1720-1725(Nov 1975).

A numerical study of the time-like geodesics in the first axially symmetric solution of the Einstein vacuum field equations given by Tomimatsu and Sato (Phys. Rev. Lett.; 29: 1344 (1972). Prog.

Theor. Phys.; 50: 95 (1973)) is made. The study is made on the equatorial plane. (auth)

19357 PROBABILITY CURRENT FOR SCALAR PARTICLE IN GENERAL RELATIVITY. Mashkour, M. A. (Mosul Univ.). Nuovo Cim., 30B: No. 1, 115-132(11 Nov 1975).

The generalized formulation for the probability distribution for scalar particle in general relativity is discussed. This is tested by the correspondence principle. It is shown in the high frequency short-wavelength limit that the generalized quantities exhibit correct physical properties. However, the formulation suffers a normalization problem. There, for example, a wave function might not be simultaneously normalizable in all reference frames. These conclusions are demonstrated in the Schwarzschild geometry, using suitable metrics, for stationary-wave solution near the event horizon and a general normalizable wave packet solution of the scalar-field equation. One also establishes the geodesic trajectory and the Heisenberg uncertainty principle for a wave packet in curved space-time. (auth)

19358 DYNAMIC EQUIVALENCE, GAUSSIAN CONSTANT, AND TIME SCALE FOR THE POST-NEWTONIAN APPROXIMATION OF CLASSICAL AND RELATIVISTIC GRAVITATIONAL THEORIES. Treder, H. J. (Zentralinstitut fuer Astrophysik, Potsdam, Ger.). Ann. Phys. (Leipzig); 32: No. 4, 304-312(Jun 1975). (In German).

The post-Newtonian approximation of the gravo-dynamics of planetary motions is given by a LAGRANGIAN $L = m\,[(v^2/2) + \epsilon(v^4/c^2) + (f\mu/r) + \beta(f\mu/r)(v^2/c^2) + \gamma(f^2\mu^2/c^2r^2)]$. For $\epsilon = 1/8$, $\beta = 3/2$ and $\gamma = -1/2$ this Lagrangian is the well known function for Einstein's geodesic motion in an isotropic Schwarzschild metric. The perihel motion is given by Tisserand's formula $\delta\varphi = \Omega\,[2\pi f\mu/c^2a(1-e^2)]$ with $\Omega = 4\epsilon + 2\beta + \gamma$. L is dynamically equivalent to quasi-Newtonian Lagrangians for which the Newtonian potential is corrected by one of the additive terms $[(\Omega/4)\,m\,(v^4/c^2)$, $(\Omega/2)\,(fm\mu/r)\,(v^2/c^2)]$ or $\Omega m\,(f^2\mu^2/c^2r^2)$. This equivalence holds for certain non-Newtonian choices of space and time measures. These non-inertial reference-systems correspond to the general relativistic coordinate systems for $\beta + \gamma = 1$, $4\epsilon + \beta = 2$, and $4\epsilon - \gamma = 1$, respectively. (auth)

19359 GRAVIMETRIC INTERACTION POTENTIAL AND THE CORRECTIONS OF THE GAUSSIAN GRAVITATIONAL CONSTANT IN THE POST-NEWTONIAN APPROXIMATION OF CLASSICAL AND RELATIVISTIC GRAVITATION THEORIES. Treder, H. J. (Zentralinstitut fuer Astrophysik, Potsdam, Ger.). Ann. Phys. (Leipzig); 32: No. 4, 313-320(Jun 1975). (In German)

The Lagrangians and the interaction potentials are given for the post-Newtonian approximation of the one-body problem according to the classical and the relativistic theories of gravitation. From these interaction potentials the general formulas are found for the post-Newtonian corrections to Kepler's laws and to the Gaussian gravitation constant with corresponding corrections for the astronomical distances. These corrections give an absolute measure of the differences between "dynamically equivalent" gravitation theories. (auth)

19360 GRAVITATIONAL INSTABILITY OF VACUUM AND COSMOLOGICAL PROBLEMS. Fomin, P. I. (Inst. of Theoretical Physics, Kiev). Dopov. Akad. Nauk Ukr. RSR, Ser. A; No. 9, 831-835(Sep 1975). (In Ukrainian)

It is shown that when the gravitational interaction is taken into account, the physical vacuum can partially dissociate into particles and antiparticles in a spontaneous manner without violating any conservation laws. A possible cosmological significance of this effect is discussed. The vacuum cosmological model is formulated in which vacuum is taken as the initial state of metagalaxy. A generalization of Einstein's classical cosmological equations is made which allows one to take phenomenologically into account the effect of vacuum gravitational instability. (auth)

19361 GRAVITATIONAL FIELD OF A HOMOGENEOUS PLATE WITH A NONZERO COSMOLOGICAL CONSTANT. Horsky, J. (Univ., Brno). Czech. J. Phys.; 25: No. 10, 1081-1083(1975).

A static interior solution of Einstein gravitational equations with $\Lambda \neq 0$ generated by a plane plate of a constant mass density is found. It is shown how to join this interior solution with the exterior metric as well. (auth)

19362 GRAVITATIONAL FIELD EQUATION. Bitsadze, A. V. (Inst. of Mathematics, Moscow). Dokl. Akad. Nauk SSSR; 222: No. 4, 765-768(1 Jun 1975). (In Russian).

An axially-symmetrical, gravitational field was described in equation form by F. Ernst. A simple method of constructing classes of solution for this equation is presented. (SJR)

19363 KERR SOLUTION: A GEOMETRICAL CONSTRUCTION. Hogan, P. A. (Univ. of Texas, Austin). Nuovo Cim.; 29B: No. 2, 322-339(11 Oct 1975).

An expression for the metric tensor η_{ij} of Minkowski space-time is derived in terms of a coordinate system adapted to a timelike world-tube and a shear-free, twisting congruence of null geodesics k^i emanating into the future from every event on the world-tube. By requiring the tube to represent the history of a rigid, unaccelerated, nonrotating, axially symmetric ellipsoid (in a technical sense) the null congruence is found to coincide with the null congruence of the Kerr solution which is tangent to the multiple Debever-Penrose direction of that solution. If one takes the Minkowski metric tensor as a background for a Kerr–Schild metric, $\eta_{ij} + 2Hk_ik_j$, the Kerr solution is readily obtained by solving Einstein's vacuum field equations for the only remaining unknown—the scalar potential H. It is proven that if the world-tube is static (unaccelerated and rigid) and has spatially compact normal sections, which are not necessarily axially symmetric, then the background geometry is flat if and only if the normal sections are axially symmetric ellipsoids. In so far as the work emphasizes the role of the properties of the basic world-tube in the construction, it may be considered as complementing the recent work of Newman and Winicour and of Vaidya on the same topic. (auth)

19364 NONSTATIC CHARGED FLUID SPHERE IN GENERAL RELATIVITY. Banerjee, A. (Jadavpur Univ., Calcutta); Chakravorty, N.; Duttachoudhury, S. B. Nuovo Cim.; 29B: No. 2, 357-363(11 Oct 1975).

It is shown that models for a nonstatic charged fluid sphere with nonvanishing pressure undergoing isotropic contraction or expansion can be constructed satisfying certain physical conditions such as both density and pressure of the matter are positive. Such spheres, in general, collapse to a point singularity. In one case, however, the system may bounce back after reaching a minimum volume, provided a tension is allowed within the distributions. (auth)

19365 GENERATION OF GRAVITATIONAL WAVES BY A STRONG ELECTROMAGNETIC WAVE SCATTERED BY ELECTRONS IN A MAGNETIC FIELD. Ternov, I. M.; Khalilov, V. R.; Chizhov, G. A. (Moscow State Univ.). Zh. Eksp. Teor. Fiz.; 68: No. 6, 1969-1974(Jun 1975). (In Russian).

In the linear approximation of general relativity theory the problem is solved of generation of gravitational wave harmonics (multiples of ω_0) by an electromagnetic wave (of frequency ω_0 and amplitude E_0) scattered by electrons in a static magnetic field. It is shown that if the size of the magnetic field region exceeds $R_{char} \sim cE_0/\omega_0B$ for $\omega_0 > e_0B/mc$ (B is the magnetic field strength, m the electron mass) or $R_{char} \sim c/\omega_0$ for $\alpha\omega_0 < e_0B/mc$ ($\alpha = E/mc^2$, E is the electron energy), then the main contribution to the effect is due to linear (with respect to wave amplitudes) transformation of the electromagnetic waves emitted by the electron into gravitational waves on propagation of the former in a magnetic field. In particular cases ($B = 0$ or $E_0 = 0$) the results obtained agree with those of familiar work. (auth)

19366 INTERACTION OF TWO BLACK HOLES IN THE SLOW-MOTION LIMIT. D'Eath, P.D. (Department of Applied Mathematics and Theoretical Physics, Silver Street, Cambridge, England and Kellogg Radiation Laboratory, California Institute of Technology, Pasadena, California 91125). Phys. Rev. D 12: No. 8, 2183-2199 (15 Oct 1975).

The interaction of two black holes is considered under the assumptions that each black hole moves in the far field of the other and that the relative velocity is small compared to the speed of light; the black holes may rotate and possess comparable masses. A method of matched asymptotic expansions developed previously by the author is used to relate the gravitational field far from the black holes, described by a slow-motion perturbation of flat space, to the gravitational field near the holes, described by perturbations of the Kerr geometry. This leads to equations of motion and spin propagation giving the main deviations from Newtonian behavior. The derivation uses only the vacuum Einstein equations, and the resulting equations are generalizations of well-known expressions for the interaction of massive or rotating bodies in general relativity. (auth)

19367 ENERGY-MOMENTUM TENSOR: FIELD-THEORETIC APPROACH FOR COUPLED GRAVITATIONAL AND ELECTROMAGNETIC FIELDS. Cavalleri, G. [CISE (Centro Informazioni Studi Esperienze), Segrate (Milano), and Università di Milano, Milano, Italy)]; Spinelli, G. Phys. Rev. D 12: No. 8, 2200-2202 (15 Oct 1975).

The deduction of the energy-momentum tensor from a variational principle is clarified in the field-theoretic approach starting from the unrenormalized flat space-time. The procedure is applied to coupled gravitational and electromagnetic fields obtaining the relevant, total

energy-momentum tensor to second order in the gravitational coupling constant f. (auth)

19368 GRAVITATION FIELD THEORY IN FLAT SPACE (IN THE PRESENCE OF AN ELECTROMAGNETIC FIELD) WITH THE MOST GENERAL STRESS TENSOR: EQUIVALENCE WITH EINSTEIN'S THEORY. Cavalleri, G. [CISE (Centro Informazioni Studi Esperienze), Segrate (Milano), and Università di Milano, Milano, Italy)]; Spinelli, G. Phys. Rev. D 12: No. 8, 2203-2207 (15 Oct 1975).

Gravitational field equations and equations of motion for charged particles are obtained by an iterative method, starting from a Lagrangian density in the "unrenormalized" flat space-time. Assuming (a) that the proper masses and charges of the particles are constant and (b) that the gravitational potential is a tensor (no scalar component) in the linearized version (first order in the coupling constant f) we obtain, by imposing consistency to all orders in f, Einstein's theory which is therefore sounder in the field-theoretic approach than in the usual Riemannian one where there is some arbitrariness (cosmological term, etc.). The convergence of our procedure is based on Deser's method but also includes the presence of electromagnetic fields and considers in addition to the energy-momentum tensor $T_{\alpha\beta}$, the most general divergenceless tensor $t_{\alpha\beta}$ depending on four arbitrary parameters which prove to be no longer observable in the "renormalized" space. (auth)

19369 SOLUTIONS FOR GRAVITY COUPLED TO MASSLESS GAUGE FIELDS. Yasskin, P.B. (Center for Theoretical Physics, Department of Physics and Astronomy, University of Maryland, College Park, Maryland 20742). Phys. Rev. D 12: No. 8, 2212-2217 (15 Oct 1975).

An explicit procedure is presented so that from each solution of the coupled Einstein-Maxwell equations for gravity and source-free electromagnetic fields, one can construct a set of solutions of the coupled Einstein-Yang-Mills equations for gravity and source-free, unquantized, massless, gauge fields for any gauge group which has an invariant metric. These solutions show that the Rainich-Misner-Wheeler "already unified field theory" cannot be extended to massless gauge fields. As an example of the procedure a solution is constructed which describes the exterior of a rotating black hole which has gauge charges such as isospin and hypercharge. A curved-space generalization of the Wu-Yang solution is shown to be a special case except written in a different gauge. Such black-hole solutions with massless gauge fields question Wheeler's "black holes have no hair" conjecture. (auth)

19370 GAUGE INVARIANCE OF GRAVITATIONAL THEORY. Friedman, M.H. (Department of Physics, Northeastern University, Boston, Massachusetts 02115). Phys. Rev. D 12: No. 8, 2528-2529 (15 Oct 1975).

Einstein's theory of gravitation is gauge invariant under $SL(2, C)$ and $GL(4, R)$. Here we discuss the latter invariance using the customary differential formulation. (auth)

19371 GHOST NEUTRINOS IN THE EINSTEIN–CARTAN THEORY OF GRAVITATION. Letelier, P. S. (Boston Univ., Mass. (USA)). Phys. Lett., A; 54: No. 5, 351-352(6 Oct 1975).

Various restrictions on the curvature tensors of Einstein-Cartan spaces are found to imply the non-existence of ghost neutrinos in these spaces. A solution to the EC-Weyl equations characterized by Minkowski metric and nonzero curvature is exhibited. (NL)

19372 TWO-POINT TENSOR ANALYSIS OF THE KINEMATICS AND CONSERVATION LAWS OF RELATIVITY. Lathrop, J. D. Boston; Harvard Univ. (1974). 134p. University Microfilms Order No. 75-18,081.

Thesis (Ph. D.).

It is illustrated how two-point tensor analysis may be used to render discussions in relativity coordinate independent. One presents a covariant treatment of kinematics in relativity, illustrated by an analysis of local motion in the Godel universe, in which the inertial acceleration is covariantly decomposed into its impressed, D'Alembert, Coriolis, centrifugal, Euler, and tidal gravitational components; a formulation of the spectral shift of light which covariantly divides the shift into its gravitational and Doppler components; and a derivation of the covariant formulas for the conserved total four-momentum and angular momentum of an isolated physical system. (Diss. Abstr. Int., B)

REACTOR TECHNOLOGY AND REGULATION

Refer also to abstracts 17694 and 18758.

19373 (CONF-740341-P2) 1974 ELECTRIC UTILITY ENGINEERING CONFERENCE, PITTSBURGH, PENNSYLVANIA, MARCH 3–15, 1974. Volume II. Nuclear Power. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). 1974. 221p. Westinghouse Electric Corp., Pittsburgh, PA $5.00.

Separate abstracts were prepared for 12 of the 13 papers included. An abstract for one paper has previously appeared in NSA. (JWR)

For abstracts of individual papers see: 17282, 19409–19416, 19582, 19615, and 19623.

19374 (CONF-750515-) PROCEEDINGS OF THE SECOND SYMPOSIUM TRAINING OF NUCLEAR FACILITY PERSONNEL, GATLINBURG, TENNESSEE, MAY 11–14, 1975. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.). May 1975. 347p. Dep. NTIS $10.00.

Twenty-eight papers are presented. Separate abstracts and indexing were prepared for each paper. (DG)

For abstracts of individual papers see: 16680, 16704–16709, 19375–19393, and 19417.

19375 (CONF-750515-, pp 2-18) TRAINING OF NUCLEAR FACILITY PERSONNEL: BOON OR BOONDOGGLE. Remick, F. J. (Pennsylvania State Univ., University Park). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

The training of nuclear facility personnel has been a requirement of the reactor licensing process for over two decades. However, the training of nuclear facility personnel remains a combination of boon and boondoggle. The opportunity to develop elite, well trained, professionally aggressive reactor operation staffs is not being realized to its full potential. Improvements in the selection of personnel, training programs, operational tools and professional pride can result in improved plant operation and contribute to improved plant capacity factors. Industry, regulatory agencies, professional societies and universities can do much to improve standards and quality of the training of nuclear facility personnel and to improve the professional level of plant operation. (auth)

19376 (CONF-750515-, pp 19-32) TRAINING REQUIREMENTS FOR NUCLEAR POWER PLANT PERSONNEL. Buzy, J. J. (U. S. Nuclear Regulatory Commission, Washington, DC). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

The Code of Federal Regulations requires that Safety Analysis Reports for Nuclear Power Plants contain the training programs for facility personnel. The training programs are required at the PSAR and FSAR review period. Training program requirements are outlined in the NRC Regulatory Guides and in Industry Standards. NRC review policy and acceptance criteria are contained in Regulatory Standard Review Plans. Current NRC policy is described. Trained and qualified personnel are required at various phases of plant construction and operation, therefore training programs must be developed and initiated with these objectives. Training programs for replacement personnel, requalification programs for licensed operators, and refresher training for other staff members are required for the full term of the facility operating license. (auth)

19377 (CONF-750515-, pp 33-52) INSPECTION OF TRAINING ACTIVITIES BY THE NRC'S OFFICE OF INSPECTION AND ENFORCEMENT. Ruhlman, W. A. (U. S. Nuclear Regulatory Commission, Washington, DC). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

New requirements in the Code of Federal Regulations, the issuance of new Regulatory Guides and ANSI Standards, have indicated the increased emphasis being placed on training by forces in the Nuclear Industry and the Nuclear Regulatory Commission. A brief description is presented of the functions of the Office of Inspection and Enforcement in the training areas. Three areas are examined: general inspection techniques; training inspection scope; and training inspection bases. (auth)

19378 (CONF-750515-, pp 53-70) U. S. NUCLEAR REGULATORY COMMISSION OPERATOR AND SENIOR OPERATOR LICENSE 1971–1974 EXAMINATION RESULTS. Collins, P. F. (U. S. Nuclear Regulatory Commission, Washington, DC). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

Examination results are presented for the years 1971–1974. The results are presented by type of license applied for and type of examination administered. The average category grades are given for operator applicants and senior operator applicants. (auth)

19379 (CONF-750515-, pp 71-84) WHY OPERATORS FAIL LICENSING EXAMINATIONS. Roth, D. R.; Zerbo, J. N. (General Physics Corp., Columbia, MD). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

A survey was conducted among nuclear utility operators who have taken NRC licensing examinations to determine which factors they considered important in their success or failure. The operators also compared the actual NRC examination with their expectations prior to taking the examination. The results of the survey supplement NRC statistics with regard to failure rates. Over 350 operators and 20 utilities participated in the survey and a good cross section of the nuclear community is represented. Reactor theory and emergency procedures are important areas in which operators found NRC emphasis to be different than expected. Observation Training and Design Lecture Series are two training segments which appear to require improvement. Recommendations are made for the use of data collected through this survey and for continuation of the effort to give operators a mechanism of supplying feedback to the training and licensing process. (auth)

19380 (CONF-750515-, pp 85-92) ERDA OUTLOOK ON TRAINING OF NUCLEAR FUEL CYCLE PERSONNEL. McCool, W. J. (Energy Research and Development Administration, Washington, DC). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hindsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

The basis for training and certification of nuclear facility personnel is discussed pursuant to the authority set forth in the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974, ERDA Manual Chapter issuances and procurement regulations. The current status of ERDA's training requirements is described with respect to responsibility, implementation, uniformity, and quality of programs. An overview of the future direction of ERDA's role in promulgating training program standards and objectives is presented. The concern of society, the matter of equivalence, the needs of the operating nuclear facilities and the thrust of the Energy Reorganization Act of 1974 are cited as bases for proposed expansion of the health and safety and environmental overview of ERDA programs. (auth)

19381 (CONF-750515-, pp 171-185) PLANNING TO MEET FUTURE MANPOWER REQUIREMENTS. Deutsch, R. W. (General Physics Corp., Columbia, MD). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); Amer-

ican Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

Most organizations in the nuclear industry will have to hire inexperienced personnel who may also lack academic qualifications in order to satisfy their future manpower requirements. It will be necessary to utilize appropriate in-house training programs to prepare personnel for particular job responsibilities as well as meet quality assurance requirements that satisfy NRC and ANSI standards. In particular, these programs will have to be directed at providing future sources of engineers, operators, and technicians. Specific programs for engineers, commercial plant operators, and technicians and maintenance personnel are described. It is the responsibility of management of major organizations in the industry to initiate and implement training programs that will provide the necessary numbers of trained personnel. (auth)

19382 (CONF-750515-, pp 187-193) STATION STAFF: SOURCES, SELECTION, AND TRAINING OF QUALIFIED CANDIDATES. Thomas, E. L. (Duke Power Co., Charlotte, NC). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

Increased experience with large commercial nuclear power generating facilities has provided additional insight into the areas of personnel acquisition and training. The current sources of trainable manpower are discussed and the characteristics and training requirements of each group are described. Applicant screening and the associated requirements of the Civil Rights Act, Fair Credit Reporting Act, Family Education and Privacy Act, and the Security Regulations of the Atomic Energy Commission are also discussed. (auth)

19383 (CONF-750515-, pp 205-211) REACTORS ALSO INVOLVE PEOPLE. Hurt, H. B. (Union Carbide Corp., Oak Ridge, TN). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

As the nuclear industry develops it is to be hoped that high quality occupational health programs will evolve along with other sound operational procedures and practices. The immediate involvement of occupational health personnel may well afford a safety factor which will minimize the likelihood of either the selection of personnel not adequate for the full responsibilities of their work or the continuation in responsible positions of personnel who develop handicaps of either a physical or mental nature. (auth)

19384 (CONF-750515-, pp 213-223) STAFFING TRAINING PROGRAMS FOR COMMONWEALTH EDISON COMPANY. Raguse, R. H. (Commonwealth Edison Co., Chicago). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

Included are comments on requirements and qualifications for personnel engaged in training nuclear power plant employees. (DG)

19385 (CONF-750515-, pp 235-251) TRAINING NUCLEAR TECHNICIANS IN TWO-YEAR, POST-SECONDARY EDUCATIONAL PROGRAMS. Hull, D. M.; Roney, M. W. May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

An available and economical supply to future manpower requirements for various types of nuclear technicians can be met by developing and/or restructuring two-year, post-secondary programs at local educational institutions. The Technical Education Research Centers program is under contract from the U.S. Office of Education to delineate the job requirements and develop curricula and instructional materials for two-year, post-secondary training of nuclear technicians. Six job categories have been identified along with corresponding tasks which the technician performs. These categories are: Reactor Operator, Nuclear Instrumentation Technician, Nuclear QA/QC Technician, Radiochemistry Technician, Radiation Protection Technician and Nuclear Medicine Technician. For the first five categories curricula have been established, courses have been described, and instructional materials are being written. (auth)

19386 (CONF-750515-, pp 253-260) TRAINING PROGRAM FOR NUCLEAR UTILITIES. Jones, D. W. (Memphis State Univ.). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

Several questions must be addressed by a university which plans applied training for nuclear utilities. Among those problems are: (1) what type of training is needed by nuclear utilities, (2) what mode of delivery should be used, and (3) how should the training be structured within the university. The Memphis State University answers to these problems are presented and the potential effect upon the university curriculum is discussed. (auth)

19387 (CONF-750515-, pp 261-270) TRAINING OF ENGINEERING SUPPORT PERSONNEL AT NORTH CAROLINA STATE UNIVERSITY. Bohannon, J. R. Jr. (North Carolina State Univ., Raleigh). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

The sources of planning for the development of curricula for engineering support personnel for the nuclear industry in general and nuclear facilities in particular have included the deliberate acquisition of inputs from employers, feedback from past students, and the critique of curricula by the industry, students, and faculty. As a result, three principal courses were developed in the Department of Nuclear Engineering, namely, Reactor Systems which deals in terms of the design engineer's and owner's concerns with regard to functional requirements, design criteria, and objectives of reactor systems; Reactor Operations which applies the student's basic engineering education to the role of an engineer in nuclear facilities, with particular attention to power plant operations; and Quality Assurance which provides the student with the bases, engineering implications and engineer's role in quality assurance during the design, construction, delivery and operation of nuclear and other complex facilities. A summary of the results to date of this trinity of courses is presented, with particular attention to its acceptance by the industry. (auth)

19388 (CONF-750515-, pp 271-275) GE AUTOTUTORIAL REQUALIFICATION PROGRAM. Howard, D. E. (General Electric Co., San Jose, CA). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

The GE program is broken into eight sections designed to be used at the rate of one per month. Each section starts with a diagnostic examination. The passing grade on this examination is 100 percent. Should an examinee answer any question incorrectly, he must view a short segment of color video tape which will discuss the correct answer to the question, discuss any generic problem indicated by an incorrect answer, and tell him what he must do to update his knowledge in this area of weakness. As part of this update, a series of appendix lectures, also on color video tape, are included which cover generic subject areas such as control rod withdrawal blocks. These lectures are referenced, as applicable, as part of the answers to the diagnostic exam questions. By proceeding through the eight sections in this manner each licensee should be able to update his knowledge as to plant evolutions he seldom, if ever, has to perform. The eight sections of the program cover all phases of plant operation except steady state power operation and cold shutdown. (auth)

19389 (CONF-750515-, pp 277-291) ROLE OF UNIVERSITIES IN TRAINING NUCLEAR FACILITY PERSONNEL. Hornyik, K.; Wang, C. H. (Oregon State Univ., Corvallis). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

The universities have a long tradition, a vast pool of experience, and the proper facilities to make significant contributions to the supply of qualified manpower to nuclear industry. Their capabilities will have to be relied upon and indeed will have to be expanded if nuclear power is to provide a major share of energy demand for the next several decades. It is the responsibility of universities to devise long-range plans to train people for various tasks associated with nuclear power development including research, design, construction, and management. Lack of communication and conflicting interests between pure research and applied project orientation of their efforts are seen as the main obstacles. These problems are given a close scrutiny and solutions are suggested, some of which already have been implemented successfully at Oregon State University and some other institutions. (auth)

19390 (CONF-750515-, pp 293-304) TRAINING OF NON-LICENSED PERSONNEL. Hetrick, D. E. (GPU Service Corp., Reading, PA). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

The safety and efficiency with which a station operates is a function of the competence and proficiency of all personnel. This includes the nonlicensed personnel who make up the bulk of the station staff. Thus the training of these members of the station complement is an important function in overall station performance. Standards, regulations, regulatory guides, and codes provide guidance to the training requirements for such personnel. Training needs and objectives must be established, a plan prepared and then all incorporated into a training program. A well planned and operated training program will stimulate effective communications between the different groups within the station and between the station and off site support groups. (auth)

19391 (CONF-750515-, pp 305-321) SURVEY OF MAINTENANCE TRAINING IN POWER PLANTS IN THE UNITED STATES. Schmidt, W. J. (NUS Corp., Rockville, MD). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second sympoisum on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

A survey was made to determine the extent of skills training for maintenance personnel in nuclear power stations. Of some 25 nuclear power plants surveyed, skills training is only offered to the maintenance personnel by three utilities. However, it was clear that several utilities already have firm plans to initiate skills training by the end of 1975, and that many others will undoubtedly be offering skills training in 1976. (auth)

19392 (CONF-750515-, pp 323-336) DEVELOPING AND SCHEDULING MAINTENANCE TRAINING PROGRAMS. Gammuto, J. J. (Commonwealth Edison Co., Chicago). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

A description is given of the development and scheduling of maintenance training programs for generating station personnel. The systematic procedure used for course development and the scheduling of training sessions at central and on-site locations are discussed. (auth)

19393 (CONF-750515-, pp 337-342) TRAINING OF QUALITY ACHIEVING PERSONNEL FOR THE CONSTRUCTION OF NUCLEAR PLANTS. Beaudoin, W. H. (Tennessee Valley Authority, Knoxville). May 1975.

From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).

In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).

Brief comments are made on TVA activities directed toward the training of construction personnel during the past few years. (DG)

19394 SAFETY OF NUCLEAR POWER PLANTS WITH DISSOCIATING COOLANTS. Sharovarov, G. A. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 2, 11-74(1974). (In Russian)

Safety of the atomic energy stations with dissociating coolants is considered. More dangerous accidents and the means to cool the reactor are discussed. (auth)

19395 9TH WORLD ENERGY CONFERENCE, DETROIT, MICHIGAN, SEPTEMBER 22-27, 1974. Preprints. Division 4: Energy Conversion. London; World Energy Conference (1974). vp. (In English and French). (CONF-740910-P4).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974).

Forty-seven papers are presented on energy requirements, supplies, and planning. Eighteen papers relating to nuclear power were abstracted separately or listed by title for NSA. (HDR)

For abstracts of individual papers see: 16700, 16701, 16714, 16843, 17902, 19396–19398, 19404, 19423, 19453, 19456, 19457, 19494, 19566–19568, and 19619.

19396 NUCLEAR STEAM STORAGE PLANT: AN ECONOMIC METHOD OF PEAK POWER GENERATION. Gilli, P. V. (Univ. of Tech., Graz); Beckmann, G. pp Paper 4.1-10, 19p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-P4.

A nuclear peaking plant based on steam storage is proposed that is suitable for all reactor systems. It exhibits the following features: Steam storage by varying pressure type (Ruths) or displacement type (constant pressure) accumulators; the use of superheated steam; the use of a separate peak load turbine with essentially constant inlet conditions; and the use of a multipressure condenser. The proposed nuclear peaking plant combines the following main advantages: high storage efficiency; economical discharge period (6 hour discharge period for 50 or more discharges per year); no changes in the design and lay-out of the nuclear base-load plant; constant thermal power, minimizing temperature cycling of reactor and fuel elements; immediately available due to the use of present-day technology, and suitable for any site; possibility of increasing the capacity (discharge period) at a later stage by adding some more storage vessels; no environmental pollution. (auth)

19397 TRENDS OF THE DEVELOPMENT OF THE NUCLEAR POWER INDUSTRY IN THE USSR. Ermakov, G. V.; Troitsky, A. A.; Tatarnikov, V. P. pp Paper 4.1-16, 10p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-P4.

Information is presented on the fuel and energy resources of the Soviet Union, the geographic location of the electric power consumers, and the role of the nuclear power stations in the country's electric power industry. Modern types of reactors and prospects of their development are considered, and the main ways of solving the problems of heat and power supply for the needs of the national economy with the help of nuclear energy in the near future are described. (auth)

19398 IMPACT OF NUCLEAR ENERGY IN METROPOLITAN AREAS-GREATER STOCKHOLM. Ryman, J. E.; Holmin, N.; Wallenberg, B.; Lindroth, C.; Oknemark, B. (Stockholm Energy Supply Authority). pp Paper 4.1-20, 9p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-P4.

Within the Greater Stockholm area intensive investigations concerning district heating supplies have been in progress for some years. Results indicate that extending installations for combined electric power and heat production provides a more rational method of dealing with raw energy, as well as possibilities for an improved economy. It also contributes to a better environment, and offers better flexibility than other solutions. If the power plant is based on nuclear energy, great quantities of waste heat can be utilized. This implies a considerably lower oil consumption resulting in reduced oil imports and reduced flue gas discharge. By siting nuclear power stations in the neighborhood of large towns, it is possible to utilize the great quantities of waste heat and at the same time solve the heat supply problem. (auth)

19399 TEPLOVYE I ATOMNYE ELEKTROSTANTSII. (Thermal and Nuclear Electrical Power Plants). Sterman, L. S.; Sharkov, A. T.; Tevlin, S. A. Moscow; Atomizdat (1975). 496p.

This book presents the theoretical principles required for the design and operation of thermal electrical power plants using fossil or nuclear fuel. Methods of calculating economic operating indices of power plants are illustrated. Subjects under discussion include the following: regenerative superheating of the feed water to the generator, turbine efficiency, heat balances, steam genera-

tors, operational reliability of equipment, particle removal, water treatment and topping cycles. (SJR)

19400 ELECTRICITY PRODUCTION FROM NUCLEAR SOURCES IN YUGOSLAVIA DURING PERIOD 1980 TO 1989. Smilijanic, G. (Inst. Ruder Boskovic, Zagreb). Elektrotehnika (Zabreb); 17: No. 4, 187-195(1974). (In Slovene).

The International Atomic Energy Agency made a potential nuclear market survey for developing countries on economic competitive bases. The survey has considered 14 countries, including Yugoslavia. Conclusions of the survey concerning Yugoslavia are presented. More than 80% of added thermal capacities in Yugoslavia in the period 1980-1989 would be nuclear according to the survey. (Electr. Electron Abstr.)

19401 NUCLEX 75. Special Preview of the Exhibition on Basle, 7 to 11 October. Nucl. Eng. Int.; 20: No. 235, vp(Oct 1975).

A special preview is presented of the Nuclex 75 Exhibition at Basle, Switzerland, October, 1975. Company activities covering fifteen countries in the Western World, Japan, and the Comecon group are described under countries. (UK)

Power Reactors, Non-Breeding, BWR-Type

Refer also to abstracts 19559, 19562, 19563, and 19574.

19402 (RT/ING-(75)13) BOILING SUBLAYERS ALONG HEATED WALLS. Cumo, M.; Farello, G. E.; Ferrari, G.; Montanari, M. (Comitato Nazionale per l'Energia Nucleare, Rome (Italy)). Jul 1975. 31p. Dep. NTIS (US Sales Only) $5.00.

The development of two-phase boundary layers along heated walls has been investigated by means of high-speed cinematography and Schlieren techniques. Particular reference is done for mixing and D.N.B. problems in L.W.R. rod bundles. (auth)

19403 METHOD FOR GENERATING A CONTROL ROD PROGRAM FOR BOILING WATER REACTORS. Kawai, T. (Atomic Energy Research Lab., Kawasaki, Japan); Motoda, H.; Kiguchi, T.; Ozawa, M. Nucl. Technol.; 28: No. 1, 108-118(Jan 1976).

The OPROD computer code has been developed to generate a long-term control rod program, a series of control rod patterns that optimize a cycle length within various operational constraints. In the algorithm, the optimization problem is decomposed into two hierarchies. In the inner loop, a time-invariant target power distribution is assumed, and a control rod pattern is determined so as to best fit the power distribution to the target within the constraints at each burnup step. The target is then improved in the outer loop to achieve a longer cycle length. The code consists of two major parts: a three-dimensional boiling water reactor (BWR) core simulator and MAP, the method of approximate programming. It readily generates a long-term control rod program of BWRs without trial search by core-management engineers. The OPROD has therefore facilitated prompt response to varying operating conditions and the investigation of a conflicting relationship between the thermal limitation and the cycle length. (auth)

19404 INTRODUCTION OF NEW POWER GENERATION SYSTEMS: IMPLICATIONS OF LWR EXPERIENCE. Dietrich, J. R. pp Paper 4.1-15, 24p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-P4.

19405 SCANIAN TOWNS RECEIVE NUCLEAR HEAT. Blomqwist, O.; Larsson, Y.; Josefsson, L. Tek. Tidskr.; 105: No. 15, 23-24, 26(3 Oct 1975). (In Swedish)

The Barseback reactor supplies heat to three towns in the South of Sweden. 950 MW is available. Steam is tapped off at 165°C (with hot water return at 70°) and taken through pipelines up to 40 km long and 1.2m dia. to the destination. The pipes are dimensioned to allow for a growth in demand. The utilization of the heat raises the total thermal efficiency of the reactor to over 60%. (NL)

19406 DEVELOPMENT OF UNDERWATER PLASMA ARC CUTTING. Wodtke, C. H.; Plunkett, W. A.; Frizzell, D. R. (Oak Ridge National Lab., TN). Weld. J. (N. Y.); 55: No. 1, 15-24(Jan 1976).

Procedures for underwater plasma arc cutting and piercing and unique operating cycles were developed to cut the 1-in. stainless steel plate of the inner thermal shield of the ERR. A plasma torch manipulator and a cutting control panel were designed and built for remote automated underwater plasma arc cutting of the inner thermal shield and for subsequent in-air cutting of other components. Commercial plasma arc cutting equipment was usable with only minor modification to torches and high frequency generator. The cutting equipment and operating procedures were demonstrated to be workable and practical by cutting and piercing fairly large test plates in a full size mockup of the ERR vessel. At the ERR, underwater plasma arc cutting and removal of the inner thermal shield were accomplished in five weeks under difficult remote working conditions. The plasma arc cutting torches and associated equipment performed satisfactorily. Certain minor changes in cutting parameters were made necessary by job circumstances. The control panel and the plasma torch manipulator proved suitable for underwater plasma arc cutting of the inner thermal shield, and also for in-air plasma arc cutting of the reactor vessel and for torch manipulation during oxyacetylene cutting of the outer thermal shield. 13 figs (auth)

19407 FUEL ASSEMBLY FOR A BOILING WATER REACTOR. Andersson, I.; Santen, A. V. (to Asea-Atom). US Patent 3,915,793. 28 Oct 1975. Priority date 22 Jun 1972, Sweden. 2p.

A boiling water reactor fuel assembly is described which has vertical fuel rods and guide tubes positioned below the fuel rods and receiving control rod fingers and acting as water pipes, the guide tubes each being formed of a plurality of parts including a part secured to a grid plate positioned in the fuel assembly container, and low parts which fit into holes formed in the bottom of the fuel assembly. There is a flexible connection between the upper and lower parts of the guide tubes to allow for a certain tolerance in the procedure of manufacturing the various parts to allow insertion of the fuel rod bundle into the fuel assembly container. (Official Gazette)

Power Reactors, Non-Breeding, PWR-Type

Refer also to abstracts 17790, 19402, 19404, 19534, 19559, 19570, 19579, and 19611.

19408 (BAW-10102(Rev.2)) ECCS EVALUATION OF B AND W's 205-FA NSS. Lowe, R. J.; Anderson, G. E. Jr.; Dunn, B. M. (Babcock and Wilcox Co., Lynchburg, Va. (USA). Nuclear Power Generation Div.). Dec 1975. vp. Babcock and Wilcox, Lynchburg, VA.

The effectiveness of the ECCS for B and W's 205-fuel assembly plants is evaluated and shown to meet all the requirements of 10 CFR 50,46. The results of various sensitivity studies, a spectrum of breaks, and an analysis to determine allowable linear heat rates under 10 CFR 50,46 are presented. 14 references (auth)

19409 (CONF-740341-P2, pp vp Paper 10) NUCLEAR POWER OVERVIEW. Retallick, F. D. 1974.

From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).

In 1974 electric utility engineering conference. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).

Westinghouse PWR steam supply system designs are reviewed. Experience with standardization of nuclear plant design is discussed. The Westinghouse reactor design and fabrication facilities are briefly described. (JWR)

19410 (CONF-740341-P2, pp vp Paper II) WESTINGHOUSE NUCLEAR POWER PLANT OPERATING EXPERIENCE. Boettinger, W. L. 1974.

From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).

In 1974 electric utility engineering conference. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).

Some significant milestones for Westinghouse PWR plants operating in 1973 are reviewed. Several tables are presented on power generation, plant availability, outages, and other operations data. (JWR)

19411 (CONF-740341-P2, pp vp Paper 12) NUCLEAR FUEL CYCLE. Bauhs, D. J. 1974.

From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).

In 1974 electric utility engineering conference. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).

The unique nature of nuclear fuel which makes it subject to unlimited management variations is discussed. An approach to determining nuclear fuel costs, based on the use of investment-time diagrams, is presented. An illustrative analysis using a Westinghouse 3800 MW(t) PWR is presented. (JWR)

19412 (CONF-740341-P2, pp vp Paper 13) WESTINGHOUSE NUCLEAR FUEL OPERATING EXPERIENCE. Roll, J. B. 1974.
From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).
In 1974 electric utility engineering conference. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).
Operating experience with Westinghouse Zircaloy-clad nuclear fuel is reviewed. Problems related to moisture, fuel densification, rod flattening, fretting, and rod bowing are discussed. (JWR)

19413 (CONF-740341-P2, pp vp Paper 15) WESTINGHOUSE PWR DEVELOPMENT. Von Hollen, H. J. 1974.
From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).
In 1974 electric utility engineering conference. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).
The Westinghouse 3817 MW(t) nuclear steam supply system is described. The goals set for the design of this reactor system are discussed. The rapid refueling feature of this reactor is described. (JWR)

19414 (CONF-740341-P2, pp vp Paper 16) FLOATING NUCLEAR PLANT. Nichols, R. C. 1974.
From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).
In 1974 electric utility engineering conference. Volume II. Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).
The development of offshore nuclear power plants is reviewed. Topics discussed include plant and site design features, steam supply system design, manufacturing concept, and siting and environmental considerations. (JWR)

19415 (CONF-740341-P2, pp vp Paper 18) NUCLEAR PLANT SERVICE REQUIREMENTS. Mendez, W. E. 1974.
From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).
In 1974 electric utility engineering conference. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).
Westinghouse development and application of systems for detection of abnormal primary circuit conditions, the use of vibration and acoustic techniques is described. The objective has been to develop systems that will result in early detection of malfunctions. (JWR)

19416 (CONF-740341-P2, pp vp Paper 19) PWR QUALITY ASSURANCE. Burgess, J. A. 1974.
From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).
In 1974 electric utility engineering conference. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).
PWR quality assurance is discussed under the following headings: organization; quality assurance programs; design control; procurement control; corrective action; and audits. (JWR)

19417 (CONF-750515-, pp 225-233) INDIAN POINT TRAINING STAFF. Burdge, R. E. (Consolidated Edison Co. of New York, Inc.). May 1975.
From 2nd ANS symposium on training of nuclear facility personnel; Gatlinburg, Tennessee, USA (11 May 1975).
In proceedings of the second symposium on training of nuclear facility personnel. (Oak Ridge National Lab., Tenn. (USA); American Nuclear Society, Hinsdale, Ill.; American Nuclear Society, Oak Ridge, Tenn.).
A description is given of the Indian Point training staff, including comments on the qualifications and duties of each member of the staff. (DG)

19418 (LIB/Trans-592) SOVIET UNION REACTOR PROGRAMME. Translated by U. Engelbert from Atomwirtsch., Atomtech.; 20: No. 4, 204-206(Apr 1975). 11p. Dep. NTIS (US Sales Only) $4.50.
A brief summary is given of nuclear power plants which are in operation or under construction in the USSR. Nuclear power plants under construction feature three different types: (1) PWR, (2) light water cooled graphite moderated reactor type and (3) sodium cooled fast breeder reactor. (RL)

19419 (SAAS-181) REPORT OF THE NATIONAL COUNCIL FOR ATOMIC SAFETY AND RADIATION PROTECTION OF THE GERMAN DEMOCRATIC REPUBLIC. (Staatliches Amt fuer Atomsicherheit und Strahlenschutz, Berlin (German Democratic Republic)). Jul 1975. 62p. (In German). Dep. NTIS (US Sales Only) $5.50.
Two reports are compiled on different aspects of nuclear safety. Separate abstracts were prepared. (JSR)

For abstracts of individual papers see: 17895 and 19420.

19420 (SAAS-181, pp 4-45) BEHAVIOR OF FISSION PRODUCTS IN Zr-CLAD FUEL ELEMENTS: SURVEY OF LITERATURE. Johannsen, K. H. Jul 1975. (In German)
In report of the National Council for Atomic Safety and Radiation Protection of the German Democratic Republic.
The fission product release from Zr-clad UO_2 fuel elements is essentially determined by the UO_2 thermal conductivity being dependent itself on density, stoichiometry and burnup. Under normal operational conditions the nearly temperature independent knock-out release, the temperature dependent steady-state release and also release by means of bubble formation and migration will occur. In the case of a reactor damage diffusion, oxidation and melting can be distinguished as mechanisms of fission product release according to the severity of the event. Because of the complexity of these mechanisms only the effects of individual parameters could be investigated up to now. The property-referred power limits of fuel rods are characterized by the thermal expansion of the UO_2, the swelling following formation of solid and gaseous fission products and the sensitivity to hydrogen (formation of zirconium hydride). 96 references. (auth)

19421 (WCAP-8297-A) EFFECT OF 17 x 17 FUEL ASSEMBLY GEOMETRY ON DNB. Hill, K. W.; Motley, F. E.; Cadek, F. F.; Wenzell, A. H. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)). Feb 1975. 123p. Westinghouse Electric Corp., Pittsburgh, PA.
A series of tests was run in which the DNB heat flux was determined in axially uniform heated rod bundles of both 17 x 17 (.374" rod) and 14 x 14 (.422" rod) reactor fuel assembly geometry. The purposes of this test series were (1) to assess the DNB performance of 374" fuel rod assembly design, (2) to verify the present design DNB methods for .374" rod geometry and (3) to obtain a body of data which will later be used to develop a new correlation. The comparison of the uniform to previously reported non-uniform axial heat flux DNB test results using the .422" rod geometry showed that use of the non-uniform heat flux F-factor used with existing correlations brings the two sets into agreement. 10 references. (auth)

19422 NOVOVORONEZH NUCLEAR POWER STATION IS TEN YEARS OLD. Voronin, L. M.; Sedov, V. K.; Skvortsov, S. A. Therm. Eng. (USSR) (Engl. Transl.); 21: No. 12, 13-17 (Dec 1974).
Translated from Teploenergetika; 21: No. 12, 7-11(Dec 1974).
The design specifications for the WWER-1, WWER-2, WWER-3, WWER-4, and WWER-5 reactors are discussed. Operating characteristics and maintenance requirements for WWER-1, WWER-2, WWER-3, and WWER-4 reactors are reviewed. (DCC)

19423 OPTIMIZATION OF THE OPERATION OF NUCLEAR POWER PLANTS. Ackermann, G.; Hampel, R.; Luetzow, K.; Meyer, K. pp Paper 4.1-8, 23p. of 9th World Energy Conference. London; World Energy Conference (1974).
From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-P4.
A description is given of a model for the optimization of the utilization of PWR nuclear power plants. The model enables selection of optimum refueling strategies by means of the algorithm of dynamic optimization. Reactor campaigns of different length and the planned utilization of stretch-out proved to be optimal. Cost savings of up to several percent are estimated for a block of a nuclear power plant in comparison to non-optimized refueling strategies. (auth)

19424 FESSENHEIM NUCLEAR POWER STATION. Lachal, M.; Hubinet, M.; Broch, E.; Broch, M. Nucl. Eng. Int.; 20: No. 234, 665-667(Sep 1975).
The Fessenheim nuclear power plant includes two PWR type units each with net electrical output of 890 MW(e). The site and layout of the station, geological features and cooling water characteristics are described. Reference is also made to other aspects of the environment such as population density and agronomy. (UK)

19425 PROGRESS OF WORK AT THE FESSENHEIM CONSTRUCTION SITE. Lachal, M.; Hubinet, M.; Broch, M. Nucl. Eng. Int.; 20: No. 234, 670-672(Sep 1975).
The Clamart Equipment Region of the EdF Equipment Management Division is responsible for the project management, construction supervision, and commissioning of the Fessenheim nuclear power station. For this purpose, the Clamart Equipment Region maintains an engineering office at Clamart and a field installation team on the site. Aspects of construction site chronology, the more specifically civil engineering aspects of construction, and preparation for testing, which is a basic requirement for proper startup, are emphasized. (auth)

19426 WORLDS REACTOR NO. 67: FESSENHEIM. Pull Out Wall Chart Drawing. Nucl. Eng. Int.; 20: No. 234, 672(Sep 1975).

A colored pull-out wall chart of the Fessenheim nuclear power station, units 1 and 2, is presented. Main parameters are listed. (UK)

19427 ROLE OF FRAMATOME IN THE FESSENHEIM PROJECT. Touchard, A. (Societe Franco-Americaine de Constructions Atomiques, Courbevoie, France). Nucl. Eng. Int.; 20: No. 234, 667-669(Sep 1975).

The contract for the nuclear steam supply system of the Fessenheim nuclear power station was awarded to Framatome. The activities involved are described. In addition to the supply of the NSSS and associated systems they include the provision of warranties, various studies to provide information for preparing equipment specifications and for forming the basis of the safety analysis report etc, and services in other fields such as equipment transport, quality control, and testing. (UK)

19428 FESSENHEIM FUEL DESIGN AND MANUFACTURE. Darolles, J. F.; Leclercq, J. (Societe Franco-Americaine de Constructions Atomiques, Courbevoie, France). Nucl. Eng. Int.; 20: No. 234, 675-678(Sep 1975).

The fuel elements in first cores of Fessenheim 1 and 2 consisted of 15 × 15 pin arrays. After revision of the ECCS criteria in 1973 a new 17 × 17 pin array was favored. Implementation of this concept involved design tasks and adaptation of manufacturing processes and procedures. Specific qualification programs which were developed for the manufacturers are described. These concerned the production of uranium dioxide pellets and zircaloy-4 cladding tubes. An integrated system, set up to administer and analyze the quality of the manufactured fuel included a traceability system for locating and identifying the fuels, and quality evaluation during manufacturing. (UK)

19429 TURBINE-GENERATOR SETS AND ANCILLARY PLANT FOR FESSENHEIM. Nucl. Eng. Int.; 20: No. 234, 678 (Sep 1975).

The most important contribution of the Alsthom Group to Fessenheim nuclear power station is the supply of the two turbine-generator sets. Rated at 1000 MW approximately at 1500 r.p.m., these sets are the first ones built of the model selected by EdF for the French nuclear program under which 22 units are presently being manufactured by, ordered, or on option from Alsthom. The main characteristics are quoted. (auth)

19430 USE OF CHERENKOV DETECTOR FOR MONITORING THE FISSION PRODUCT CONCENTRATION IN THE COOLING WATERS OF ATOMIC POWER PLANTS WITH PWR. Oravec, J.; Melichar, Z. Radioisotopy; 15: No. 6, 895-911(1974). (In Czech)

It was experimentally proved that the Cherenkov detector is not sensitive enough for the detection of slight fuel rod failures according to the fission product concentration in the primary circuit. The Cherenkov detector is sufficiently sensitive for detecting the fission product penetration into the secondary circuit and for the measurement of the liquid waste concentration. (Czech. Biblio.)

19431 FLUID DISTRIBUTION NETWORK AND STEAM GENERATORS AND METHOD FOR NUCLEAR POWER PLANT TRAINING SIMULATOR. Alliston, W. H.; Johnson, S. J.; Mutafelija, B. A. (to Westinghouse Electric Corp.). US Patent 3,914,795. 21 Oct 1975. Filed date 23 Feb 1973. 30p.

A description is given of a training simulator for the real-time dynamic operation of a nuclear power plan: which utilizes apparatus that includes control consoles having manual and automatic devices corresponding to simulated plant components and indicating devices for monitoring physical values in the simulated plant. A digital computer configuration is connected to the control consoles to calculate the dynamic real-time simulated operation of the plant in accordance with the simulated plant components to provide output data including data for operating the control console indicating devices. In the method and system for simulating a fluid distribution network of the power plant, such as that which includes, for example, a main steam system which distributes steam from steam generators to high pressure turbine steam reheaters, steam dump valves, and feedwater heaters, the simultaneous solution of linearized non-linear algebraic equations is used to calculate all the flows throughout the simulated system. A plurality of parallel connected steam generators that supply steam to the system are simulated individually, and include the simulation of shrink-swell characteristics. (Official Gazette)

19432 TRAINING SIMULATOR FOR NUCLEAR POWER PLANT REACTOR MONITORING. Alliston, W. H.; Czerniejewski, F. R.; Mutafelija, B. A. (to Westinghouse Electric Corp.). US Patent 3, 916,444. 28 Oct 1975. Filed date 23 Feb 1973. 40p.

A description is given of a method and apparatus for the real-time dynamic simulation of a nuclear power plant that includes a control and nuclear instrumentation console for operating the reactor and monitoring three-dimensional physical values in the reactor core. A digital computer is connected to the console to calculate physical values such as nuclear flux, power, and temperature including the distribution thereof throughout the core with such calculations including the effect of full length, part length, and malfunctioned reactor control rods, as well as xenon, decay heat and boron, for example, on the output and distribution of power within the core. The simulation also includes instrumentation that responds to the calculated physical values by recording a continuous trace of the flux value in the reactor core from the top to the bottom. (Official Gazette)

19433 NUCLEAR POWER PLANT TRAINING SIMULATOR MODELING ORGANIZATION AND METHOD. Alliston, W. H. (to Westinghouse Electric Corp.). US Patent 3,919,720. 11 Nov 1975. Filed date 23 Feb 1973. 40p.

A description is given of a training simulator for the full-scope real-time dynamic operation of a nuclear power plant which utilizes apparatus that includes control consoles having manual and automatic devices corresponding to simulated plant components and indicating devices for monitoring physical values in the simulated plants. A digital computer configuration is connected to the control consoles to calculate the dynamic real-time simulated operation of the plant in accordance with the simulated plant components to provide output data including data for operating the control console indicating devices. The plant simulation is modularized into various plant components or component systems. Simulated plant components or component systems are described by a mathematical equation embodied in a computer program which accepts data from other simulated plant components or systems, calculates output values including values which are used as inputs for simulator calculators by other simulated plant components or systems, and responds in a manner similar to that of its corresponding physical entity in both transient and steady states. (Official Gazette)

19434 TRAINING SIMULATOR FOR NUCLEAR POWER PLANT REACTOR COOLANT SYSTEM AND METHOD. Alliston, W. H.; Desalu, A. A. (to Westinghouse Electric Corp.). US Patent 3,916,445. 28 Oct 1975. Filed date 23 Feb 1973. 46p.

A description is given of a method and system for simulating the dynamic real-time operation of a nuclear power plant wherein a plurality of remote control devices provides input data to a digital computer to calculate physical values corresponding to plant operation to operate indicating devices for monitoring the physical operation of the plant. The simulation includes the dynamic operation of the reactor coolant loops for normal, reverse, and natural coolant flow and corresponding heat transfer; also the simulation of the pressurizer in its solid, bubble, and transitional states together with its interaction with the reactor coolant loops. (Official Gazette)

19435 TRAINING SIMULATOR FOR NUCLEAR POWER PLANT REACTOR CONTROL MODEL AND METHOD. Czerbuejewski, F. R. (to Westinghouse Electric Corp.). US Patent 3,914,794. 21 Oct 1975. Filed date 23 Feb 1973. 16p.

A description is given of a method and system for the real-time dynamic simulation of a nuclear power plant for training purposes, wherein a control console has a plurality of manual and automatic remote control devices for operating simulated control rods and has indicating devices for monitoring the physical operation of a simulated reactor. Digital computer means are connected to the control console to calculate data values for operating the monitoring devices in accordance with the control devices. The simulation of the reactor control rod mechanism is disclosed whereby the digital computer means operates the rod position monitoring devices in a real-time that is a fraction of the computer time steps and simulates the quick response of a control rod remote control lever together with the delayed response upon a change of direction.

19436 STEAM GENERATOR FOR A PRESSURIZED-WATER COOLANT NUCLEAR REACTOR. Schroeder, H. J. (to Siemens Aktiengesellschaft). US Patent 3,915,122. 28 Oct 1975. Priority date 19 Dec 1972, German, Federal Republic of (F. R. Germany). 6p.

A description is given of a steam generator for a pressurized-water coolant nuclear reactor which is of the type having a vertical housing with its lower portion closed by a horizontal tube sheet in which the inlet and outlet legs of an inverted U-shaped tube bundle are mounted, one forming an inlet leg and the other forming an outlet leg for the pressurized-water coolant circulated via the

tube bundle and the reactor. The tube bundle is peripherally enclosed by a vertical shell forming a feed-water descent space between it and the housing with this space adjacently above the tube sheet peripherally opening to the latter for radially inwardly directed feed-water flow thereover through the interspaced tubes of the tube bundle legs and upward flow through the latter to generate steam in the housing. (Official Gazette)

19437 EMERGENCY CORE COOLING SPRAY HEAD. Calvin, J. N. (to Combustion Engineering, Inc.). US Patent 3,920,514. 18 Nov 1975. Filed Date 18 Oct 1973. 6p.

A description is given of an apparatus for supplying emergency coolant fluid to the core region of a nuclear reactor in the event of a loss of coolant accident. A coolant plenum is integrally formed in each of the individual fuel assemblies that comprise the reactor core. The plenums are each connected to a pressurized source of emergency coolant fluid and means are provided to discharge the fluid from the plenums into the adjacent regions of the associated fuel assemblies. (Official Gazette)

19438 PROTECTION SYSTEM FOR A NUCLEAR REACTOR. Loose, R. A.; Brown, W. W. (to Westinghouse Electric Corp.). US Patent 3,920,513. 18 Nov 1975. Filed Date 18 Apr 1973. 8p.

A description is given of a protection system for a nuclear reactor which prevents reactor power excursions when conditions arise causing rapid cooldown of the reactor coolant, as when a steam break occurs in the supply line to a steam generator-turbine steam circuit, or under other conditions requiring rapid insertion of boric acid into the reactor. A pump having its inlet connected to the reactor primary coolant loop discharges into, or takes suction from, a tank containing a 12 percent boric acid or other neutron absorbing solution, and forces the solution into the remaining legs of the reactor primary cooling loop. Valves on both sides of the tank keep the tank isolated from the reactor when not in use. (Official Gazette)

19439 STEAM GENERATOR FOR A PRESSURIZED-WATER COOLANT NUCLEAR REACTOR. Schroeder, H. J.; Berger, W. (to Siemens Aktiengesellschaft). US Patent 3,916,841. 4 Nov 1975. Priority date 22 Dec 1972, German, Federal Republic of (F. R. Germany). 6p.

A description is given of a steam generator which has a vertical cylindrical housing having a steam output outlet, a horizontal tube sheet closing the lower end of this housing, and an inverted U-shaped tube bundle inside of the housing and having vertical inlet and outlet legs with their ends mounted in the tube sheet. Beneath the tube sheet there are inlet and outlet manifolds for the respective ends of the tube bundle so that pressurized-water coolant from a pressurized-water coolant nuclear reactor can be circulated through the tube bundle. (Official Gazette)

19440 REACTOR VESSEL SUPPORTED BY FLEXURE MEMBER. Crawford, J. D.; Pankow, B. (to Combustion Engineering, Inc.). US Patent 3,916,944. 4 Nov 1975. Filed date 28 Jun 1973. 6p.

A description is given of a reactor pressure vessel which is provided with vertical support means in the form of circumferentially spaced columns upon which the vessel is mounted. The columns are adapted to undergo flexure in order to accommodate the thermally induced displacements experienced by the vessel during operational transients. (Official Gazette)

19441 PRESSURIZED-WATER COOLANT NUCLEAR REACTOR STEAM GENERATOR. Mayer, H.; Schroder, H. J. (to Siemens Aktiengesellschaft). US Patent 3,921,591. 25 Nov 1975. Priority Date 26 Jun 1972, German, Federal Republic of (F.R. Germany). 4p.

A description is given of a pressurized-water coolant nuclear reactor steam generator having a vertical housing for the steam generating water and containing an upstanding heat exchanger to which the pressurized-water coolant passes and which is radially surrounded by a guide jacket supporting a water separator on its top. By thermosiphon action the steam generating water flows upward through and around the heat exchanger within the guide chamber to the latter's top from which it flows radially outwardly and downwardly through a down draft space formed between the outside of the jacket and the housing. The water separator discharges separated water downwardly. The housing has a feedwater inlet opening adjacent to the lower portion of the heat exchanger, providing preheating of the introduced feedwater. This preheated feedwater is conveyed by a duct upwardly to a location where it mixes with the water discharged from the water separator. (Official Gazette)

Power Reactors, Non-Breeding, Graphite Moderated

Refer also to abstracts 17711, 19418, 19536–19548, and 19555.

19442 (AED-CONF-75-233-004) PLANNING AND DEVELOPMENT OF THE PRESTRESSED-CONCRETE CONTAINMENT FOR THE HHT 1,050 MWe PLANT. Stuenkel, D. (Hochtemperatur-Reaktorbau G.m.b.H., Mannheim (F. R. Germany)). 1975. 8p. (In German). INIS.

From project high-temperature reactor with helium turbine–status report; Juelich, F. R. Germany (2 Jun 1975).

With abstract.

Following a comparison of the HHT and HTR vessel geometries, the stages of development of the SSB layout are described, and the results are discussed. (DE)

19443 (AED-CONF-75-233-007) PLANNING AND DEVELOPMENT OF TURBOMACHINES. Endres, W. (Deutsches Elektronen-Synchrotron (DESY), Hamburg (F. R. Germany)). 1975. 5p. (In German). INIS.

From project high-temperature reactor with helium turbine–status report; Juelich, F. R. Germany (2 Jun 1975).

3 figs. With abstract. Available from ZAED.

The development of large helium turbines has been carried on in many investigations. The integrated plant concept, i.e., the installation of the gas turbine inside the prestressed-concrete vessel of the reactor has been followed up, and its viability has been proved in many tests. A great number of investigations were dealing with the position of the whole unit inside the prestressed-concrete vessel, the number of turbines, the standardized sizes of the turbines, and the standardized size of the power plant. Special emphasis was placed on the maintenance of the turbines, their accessibility, problems of contamination, their removal and installation. The studies led to a concept of 3 horizontal gas turbines with a standard power of 350 MW or more. (DE)

19444 (DP-Report-789, pp 16-39) PRESENT STATUS OF HIGH TEMPERATURE REACTORS. Ashworth, F. P. O. (Atomic Energy Establishment, Winfrith, Eng.). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

The operating histories of the Peach Bottom-1 Reactor, Dragon Reactor, and AVR Reactor are compared. HTGR development programs are discussed. (DCC)

19445 (DP-Report-789, pp 58-96) REFERENCE CORE STUDIES. Mancini, G.; Shepherd, J.; Gray, R. E. S. (Atomic Energy Establishment, Winfrith, Eng.). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

The effectiveness of the primary fission product barriers, the particle coatings and the graphite fuel tube, is analyzed. The investigation is carried out on a whole core basis using as a model a 1500 MW(t) reference core. 14 references. (auth)

19446 (DP-Report-789, pp 171-181) TWO DIMENSIONAL DYNAMICS CODE FOR HTR'S CODE FOR HTR'S WITH TUBULAR FUEL ELEMENTS. Vincenti, E.; Clusaz, A. (Euratom-CCR, Ispra, Italy). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

This is a description of the adaptation of the code Costanza (RZ) to gas cooled reactors with hollow fuel elements, with internal and external cooling. It solves the time dependent diffusion equations in two energy groups and two geometrical dimensions (radial and axial for cylindrical reactors). The neutronics calculation is coupled with the thermohydraulics calculation of the channels, which will be described here in detail. The code considers up to 6 groups of delayed neutrons. The temperature feedback of fuel and moderator are considered independently and affect the nuclear constants. The movement of the control rods is simulated by moving the boundaries of regions containing a poison with a given absorption cross section. It is also possible to vary the poison concentration in regions with fixed boundaries. Both of these parameters may be used to attain criticality. (auth)

19447 (DP-Report-789, pp 274-301) PREDICTION OF FISSION GAS RELEASE IN AN OPERATING HTR. Shepherd, J. (Atomic Energy Establishment, Winfrith, Eng.); Kinsella, G. G.; Scott, P. A. A. Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

Present concepts of high temperature power reactor fuel inevitably imply an acceptance of some degree of continuous fission product release to the coolant. For design work, safety assessments, as a guide to the required fuel quality and for operational and maintenance planning it is necessary to have reliable methods of calculation of fission product release rates under various operating conditions. The results of the application of the method of fission gas release prediction currently in use at Dragon Project to an operational HTR, the Dragon reactor, are presented. 11 references. (auth)

19448 (DP-Report-789, pp 302-315) SAFETY AND OPERATIONAL ASPECTS OF GRAPHITE CORROSION IN HTR CORES DURING NORMAL OPERATION. Fern, C. W.; Merrett, D. J. (Nuclear Power Group, Ltd., Knutsford, Eng.). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

The corrosion of very hot graphite by minute quantities of water vapour in the helium coolant of an HTR affects both the structural integrity of the core and its ability to retain fission products. The problems for a typical design using prismatic fuel blocks containing individual tubular fuel pins are analyzed. However the general arguments are equally applicable to other HTR configurations. Main areas of interest are the fuel compact and the graphite sheath containing it. (auth)

19449 (GA-A-12821-A(Amend.A)) PCRV DESIGN AND VERIFICATION. Cheung, K. C. (General Atomic Co., San Diego, Calif. (USA)). Oct 1975. vp. (GA-LTR-8(Amend.A)), General Atomic Co., San Diego, CA.

The applicability and validity of the analytical methods, structural model testing, and finite element computer codes used in the design of multi-cavity prestressed concrete reactor vessels (PCRVs) are analyzed. 29 references (auth)

19450 (GA-A-13728) NEUTRONIC VALUES OF U-233 AND U-236 IN THE HTGR. Rothstein, M. P.; Redding, J. R.; Brogli, R. H.; Asmussen, K. E.; Lane, R. K. (General Atomic Co., San Diego, Calif. (USA)). 6 Nov 1975. Contract E(04-3)-167. 51p. Dep. NTIS $4.00.

The HTGR utilizes thorium as the fertile material and fully enriched uranium as the makeup feed material. The bred U-233 is recovered and continuously recycled. The discharged feed material is recovered and recycled once more through the reactor before being permanently retired. The bred U-233 is a valuable fuel and its intrinsic neutronic worth, i.e., parity is 1.43 times the value of fully enriched U-235. Parasitic neutron absorptions in U-236 are significant and are proportional to the product of the in-core U-236 inventory and the effective cross section of U-236. The reference recycle mode of operation limits the U-236 inventory buildup and minimizes the effective cross section of U-236. The U-236 that gradually builds up in the bred uranium is unshielded and its neutronic parity is typically -0.58 the value of fully enriched U-235. The U-236 produced in the feed uranium elements and recycled once more is heavily shielded and has a value of -0.20 to -0.25 the value of fully enriched U-235. (auth)

19451 (JUL-1241) INVESTIGATIONS OF TWO PACKED FIBER INSULATIONS IN A HORIZONTAL PRESSURE TUBE. Broeckerhoff, P.; Scholz, F. (Kernforschungsanlage Juelich G.m.b.H. (F. R. Germany). Inst. fuer Reaktorbauelemente), Oct 1975. 105p. (In German). Dep. NTIS (US Sales Only) $5.50.

In the High Pressure Gas Tunnel a fiber insulation specially designed for HHT applications was tested in a horizontal pressure tube. Such an insulation is planned or under construction for the pipe system of the HHV-loop. Pressure and temperature of the test gases air and helium were up to about 40 bar and 400°C. Temperatures and heat fluxes in the different sectors indicated satisfactory results. Natural convection, which would have caused a modification of the insulation, appeared to be only weak. Fiber densities of 280 kg/m^3 and 400 kg/m^3 respectively prevented gas movements, though the cohering gas volume in the insulation was rather big. Pressure gradients caused by the flowing gas did not influence the insulation effect. (auth)

19452 HIGH TEMPERATURE GAS COOLED NUCLEAR REACTOR. Hosegood, S. B.; Lockett, G. E. (to United Kingdom Atomic Energy Authority). British Patent 1,397,463. 11 Jun 1975. Filed date 19 Jun 1972. 5p.

For high temperature gas-cooled reactors it is considered advantageous to design the core so that the moderator blocks can be removed and replaced by means of standpipes normally situated in the top of the reactor vessel. An arrangement is described to facilitate these operations. The blocks have end faces shaped as irregular hexagons with three long sides of equal length and three short sides also of equal length, one short side being located between each pair of adjacent long sides, and the long sides being inclined towards one another at 60°. The block defines a number of coolant channels located parallel to its sides. Application of the arrangement to a high temperature gas-cooled reactor with refuelling standpipes is described. The standpipes are located in the top of the reactor vessel above the tops of the columns and are disposed coaxially above the hexagonal channels, with diameters that allow the passage of the blocks. (UK)

19453 FORT ST. VRAIN HTGR CONSTRUCTION AND START-UP EXPERIENCE. Landis, J. W.; O'Rorke, E. W. pp Paper 4.1-18, 20p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-P4.

19454 TURBULENT HEAT TRANSFER TO LONGITUDINAL FLOW THROUGH A TRIANGULAR ARRAY OF CIRCULAR RODS. Pfann, J. (Ustav Jaderneho Vyzkumu, Rez (Czechoslovakia)). Nucl. Eng. Des.; 34: No. 2, 203-219(Nov 1975).

Temperature distribution and heat transfer to longitudinal turbulent, fully developed flow through triangular arrays of smooth circular rods are analyzed for liquids with Prandtl number ~1 and $\ll 1$. Nusselt number is plotted versus pitch and turbulence for constant heat flow and for constant temperature on the rod surface, and the optimum pitch is determined. The influence of Prandtl number is analyzed. (NL)

19455 PRESSURE VESSELS HAVING THERMAL INSULATION. Brissaud, J.; Birch, W. (to Technigaz). US Patent 3,920,518. 18 Nov 1975. Priority Date 26 Oct 1971, United Kingdom of Great Britain and Northern Ireland (UK). 4p.

A description is given of a thermal barrier system for use in a pressure vessel, such as a pre-stressed concrete pressure vessel housing the pressurized primary circuit of a gas-cooled nuclear reactor, in which there is provided a metal liner, stud members fixed to the metal liner, an inner flexible membrane fixed to the stud member, and porous insulation held between the liner and the membrane. (Official Gazette)

Power Reactors, Non-Breeding, Otherwise Moderated

19456 CANDU: ECONOMIC ALTERNATIVE TO THE FAST BREEDERS. Mooradian, A. J. (Chalk River, Nuclear Labs., Ont.); Runnalls, O. J. C. pp Paper 4.1-1 of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-P4.

A discussion is presented of the CANDU reactor system and its flexibility of response to the uncertainties which are likely to characterize fuel resource recovery costs in the near term. The fuel resource question is viewed from the perspective of Canadian experience. The basis for optimism is developed for the long term supply of uranium and thorium at costs which are acceptable to the CANDU system. It is shown that the concept is not only complementary to the fast reactor but is also a viable economic alternative. (auth)

19457 PICKERING GENERATING STATION. Morison, W. G.; Beynon, C. E.; Keane, E. K.; Wardell, R. D. pp Paper 4.1-2, 21p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-P4.

The reasons for the choice of the CANDU system for the Pickering Station and the advantages it offers to the power utility are presented. The design and construction aspects and the safety features of the multi-unit station are described. Significant occurrences during commissioning of the units from the turnover from construction to in-service are described, and the subsequent operating performance is outlined. (auth)

Power Reactors, Breeding

Refer also to abstracts 17275, 19418, 19454, 19501, 19508, 19549–19554, 19560, 19561, 19576, 19577, 19610, and 19612.

19458 (ANL/RAS-75-39) IMPLICIT THREE-DIMENSIONAL FINITE-ELEMENT FORMULATION FOR THE NONLINEAR STRUCTURAL RESPONSE OF REACTOR COMPONENTS. Kulak, R. F.; Belytschko, T. B. (Argonne National Lab., Ill. (USA)). Sep 1975. 70p. Dep. NTIS $4.50.

The formulation of a finite-element procedure for the implicit transient and static analysis of plate/shell type structures in three-dimensional space is described. The triangular plate/shell element can sustain both membrane and bending stresses. Both geometric and material nonlinearities can be treated, and an elastic-plastic material law has been incorporated. The formulation permits the element to undergo arbitrarily large rotations and translations; but, in its present form it is restricted to small strains. The discretized equations of motion are obtained by a stiffness method. An implicit integration algorithm based on trapezoidal integration formulas is used to integrate the discretized equations of motion in time. To ensure numerical stability, an iterative solution procedure with equilibrium checks is used. (auth)

19459 (CENC-1238(Vol.2)) LMFBR STEAM GENERATOR DEVELOPMENT: DUPLEX BAYONET TUBE STEAM GENERATOR. Volume II. DeFur, D. D. (Combustion Engineering, Inc., Chattanooga, Tenn. (USA)). Apr 1975. Contract AT(11-1)-2426. 376p. Dep. NTIS $10.60.

This report represents the culmination of work performed in fulfillment of ERDA Contract AT(11-1)-2426, Task Agreement 2, in which alternate steam generator designs were developed and studied. The basic bayonet tube generator design previously developed by C-E under AEC Contract AT(11-1)-3031 was expanded by incorporating duplex heat transfer tubes to enhance the unit's overall safety and reliability. The effort consisted of providing and evaluating conceptual designs of the evaporator, superheater and reheater components for a large plant LMFBR steam generator (950 MWt per heat transport loop). (auth)

19460 (CRBRP-PMC-75-04) CLINCH RIVER BREEDER REACTOR PLANT PROJECT: CHIEF EXECUTIVE BRIEFING. Proceedings of the Breeder Reactor Corporation, October 1975 Information Session, Chicago, Illinois. (Clinch River Breeder Reactor Plant Project Office, Oak Ridge, Tenn. (USA)). 1975. 39p. (CONF-751028-P1). AT.

From Clinch River Breeder Reactor Project chief executive briefing conference; Chicago, Illinois, USA (Oct 1975).

Included are individual reports dealing with the following topics: ERDA commitment to the breeder program, overall CRBR status, licensing status, engineering status, the CRBR traveling exhibit and demonstration program, project control planning, public relations, and project administration. (DG)

19461 (EURFNR-1224) PAPERS CONCERNING FUEL ELEMENT DEVELOPMENT FOR THE FAST BREEDER REACTOR SNR-300. Boehm, H.; Dienst, W.; Kummerer, K. (comps.). (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Material- und Festkoerperforschung). Sep 1974. Translation of KFK-1999. 400p. Dep. NTIS $10.75.

Work performed under United States-Euratom Fast Reactor Exchange Program.

Separate abstracts are included for each of the 19 papers presented concerning the development and testing of fuel pins and fuel cladding for the SNR reactor.

For abstracts of individual papers see: 19462-19479 and 19501.

19462 (EURFNR-1224, pp 1-12) DEMANDS AND BOUNDARY CONDITIONS FOR SNR-300 FUEL ELEMENTS. Kummerer, E. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

The SNR-300 fast reactor is to have a thermal power of 730 MW(t) resulting in an electric power of about 300 MW(e). The intended fuel is U-Pu mixed oxide, the fertile material being depleted uranium oxide. The breeding rate was given in the 1971 Safety Report as 1.16. However, the more recent core designs, with their much reduced radial breeder blanket, result in a substantially reduced breeding rate. The general data, including the sodium inlet and outlet temperatures which are important for our further considerations, are presented. 17 references (auth)

19463 (EURFNR-1224, pp 13-23) ASPECTS AND PROBLEMS OF FUEL DESIGN. Dienst, W. Sep 1974. Translated From KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

Fuel design is an aspect of fuel pin design which, in addition to the basic physical, thermo-hydraulic and economic demands for the operation of a fast breeder, must meet the following conditions: avoidance of cladding defects; and avoidance of shiftings of reactivity and power density (secondarily also of cladding defects) due to melting of the fuel in the central zone. A summary is given of all events in the fuel pin which are significant as regards the occurrence of cladding defects or melting of the fuel. (auth)

19464 (EURFNR-1224, pp 24-39) INFLUENCE OF BURNUP-INDUCED PHENOMENA ON THE CENTRAL TEMPERATURE. Ondracek, G.; Schulz, B. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

The design criteria of the fast breeder fuel pin includes the central temperature. The maximum central temperature hitherto permitted has been the melting temperature of the stoichiometric $U_{0.8}Pu_{0.2}O_2$ (3033 K) although the melting temperature of even the mixed oxide with 30 w/o Pu is lower, and pins with this degree of enrichment are provided in the first core of the SNR-300. The influence of the various changes taking place in the fuel during irradiation on the central temperature with a target burnup of 100,000 MWd/t metal is assessed. The considerations apply to steady-state operation, mathematical solutions of differential equations for the case of cylindrical geometry with purely radial dependence. In cases where it was impossible to use analytical relationships for integration, integration was performed by graph. 19 references. (auth)

19465 (EURFNR-1224, pp 40-56) MECHANICAL STRESSING OF THE CLAD BY THE FUEL. Brucklacher, D.; Dienst, W.; Zimmermann, H. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

Continued investigation of the changes in diameter of irradiated oxide fuel pins has clearly shown that plastic expansions of the cladding tubes occur under irradiation. Consideration to those processes in the fuel pins which might result in a causative mechanical stressing of the fuel pin cladding is presented. 25 references. (auth)

19466 (EURFNR-1224, pp 57-74) CHEMICAL INTERACTION BETWEEN FUEL, FISSION PRODUCTS, AND CLAD. Goetzmann, O.; Hofmann, P.; Kleykamp, H. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

Observations of the fuel pins examined at Karlsruhe are presented. All details concerning the chemical interactions between the fuel, fission products and cladding, including those between the fuel and the fission products, are of interest only to the extent thay they influence clad attacks. The specific possibilities of attack of the fission products will be briefly explained once more on the basis of the microprobe photographs of the individual post-irradiation examinations. (auth)

19467 (EURFNR-1224, pp 75-83) CONCLUSION CONCERNING FUEL AND FUEL PIN DESIGN. Dienst, W. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

A number of conclusions are drawn from the results of investigations of the fuel behavior in fast breeder fuel pins. They relate to recommendations as regards the selection of design data, suggestions for illustrating the fuel pin behavior by means of a model, and a number of indications of fresh investigations required. (auth)

19468 (EURFNR-1224, pp 84-102) INFLUENCE OF IRRADIATION ON THE STRENGTH PROPERTIES OF CLADDING MATERIALS. Closs, K. D.; Schaefer, L.; Schirra, M.; Wassilew, C. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

In developing the cladding material for the SNR-300 the Germans favor stabilized austenitic steels, more particularly the Nb-stabilized steels 1.4988 and 1.4981 and also the Ti-stabilized steel 1.4970. The irradiation parameters and the individual types of experiments taken into account during the selection of the cladding material in the investigations of mechanical behavior under neutron irradiation are presented. In addition to the technologically orientated Mol-2 tests and Mol-3 F tests of Interatom on tube samples under internal pressure, in the case of the pure material irradiations more particularly tests were carried out on flat samples (Mol 3 B, 3 C and DFR 397), to

investigate systematically the influence of various mechanico-thermal pretreatments on irradiation behavior. Mechanical investigations were also carried out on cladding tube sections from cluster irradiations. 9 references. (auth)

19469 (EURFNR-1224, pp 103-119) SWELLING AND CREEP IN CLADDING MATERIALS DURING IRRADIATION. Ehrlich, K.; Herschbach, K.; Schneider, W. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

The results of a number of test groups on the swelling behavior and in-pile creep of stabilized steels are presented. Some of these irradiations were carried out with Interatom and Belgonucleaire and subsequently investigated by the GfK: fuel element irradiation in the DFR (Dounreay Fast Reactor) and Rapsodie reactors; simulation experiments on the Variable Energy Cyclotron (VEC) at Harwell; and material irradiations in the BR-2, DFR and Rapsodie reactors. 19 references. (auth)

19470 (EURFNR-1224, pp 120-131) CORROSION BEHAVIOR OF CLADDING MATERIALS. Borgstedt, H. U. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

As regards the corrosion behavior of cladding materials in liquid sodium under SNR 300 hot spot conditions, information is available from a number of loop tests which were carried out by the SCK Mol, TNO Apeldoorn and SGAE Seibersdorf. Particular importance must be attached to corrosion experiments on cladding tubes during internal pressure tests carried out and continued on the sodium high temperature test rig at the IRB. 11 references. (auth)

19471 (EURFNR-1224, pp 132-144) COMPREHENSIVE ASSESSMENT OF THE CLADDING MATERIALS INVOLVED IN SNR-300 FUEL PINS. Boehm, H. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

The criteria of selection and development of a cladding material are presented. Assessment of the present state of cladding material selection and the aspects of future developments are studied. 4 references. (auth)

19472 (EURFNR-1224, pp 145-160) MODEL-THEORETICAL TREATMENT OF FUEL PIN BEHAVIOR. Elbel, H. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

The stresses on the cladding tube set up during reactor operation should not adversely affect the fuel can function. It is therefore important to know what causes may lead to cladding tube failure, from what point a possible failure is to be expected, and whether suitable measures can be taken to avoid such failure. The use of the SATURN code to analyze fuel can failures and stresses is described. 9 references. (auth)

19473 (EURFNR-1224, pp 161-172) MODEL-THEORETICAL DESCRIPTION OF THE FUEL PIN MECHANICS OF SATURN-3. Keller, K. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

All the SATURN computer programs share the feature that they provide computed results concerning the behavior of a fuel pin during its operation in the reactor. Two important disadvantages of the previous SATURN versions make it seem desirable to develop a basically new version (SATURN-3). The program structure of SATURN-3 is presented. 6 references. (auth)

19474 (EURFNR-1224, pp 173-179) FUEL PIN SPECIFICATIONS AND THEIR ASSESSMENT. Freund, D. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

Starting with the formulation of the end in view and finishing up with the provision of results, the course of irradiation tests is an extremely complicated operation. The particular difficulties lie in the exact documentation of all the processes, which follow courses separated from one another in time and space. Fuel pin design and performance testing are described. (auth)

19475 (EURFNR-1224, pp 180-185) OXIDE SAMPLE PRODUCTION FOR THE PSB IRRADIATION PROGRAM. Wedemeyer, H. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

In the course of fuel development the PSB is developing a comprehensive irradiation program which extends from the investigation of individual parameters in short-pin specimens up to the cluster behavior of full-size assembled pins. To this program there correspond comprehensive fuel manufacturing activities which extend from laboratory operation to the industrial production of UO_2/PuO_2 pelleted fuel, the main purpose of the laboratory work being to produce short-pin specimens for parameter investigations, i.e., to produce relatively small amounts of fuel usually from rather uncommon specifications or origins. (auth)

19476 (EURFNR-1224, pp 186-198) QUALITY CHECK ON FUEL, CLADDING TUBES, AND FUEL PINS. Vollath, D.; Jacobi, O. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

The quality check on fast breeder fuel pins must cover all the parts of the fuel pin and the fuel pin itself, including the fuel, the cladding tube, and the structural parts. The manufacturing quality controls for fuel pins are described. (auth)

19477 (EURFNR-1224, pp 199-206) ESSENTIAL FUEL PIN AND CLUSTER TESTS. Freund, D. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

One of the main jobs in developing and assessing fuel pin designs for the fast sodium-cooled reactor (SNR) is the carrying out of irradiation tests. A brief survey is given of the main fuel pin and cluster tests of the second phase. 26 references. (auth)

19478 (EURFNR-1224, pp 221-232) NONDESTRUCTIVE POST-IRRADIATION EXAMINATION. Geithoff, D. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

Post-irradiation examination is a very comprehensive and widely ramified field of work which with its special investigations extend more particularly deeply into other technical fields. An overall survey would considerably exceed the intended scope, so that the present report will deal merely with nondestructive post-irradiation examination. This represents the stage of investigation through which all irradiated fuel pin specimens pass before being divided up into special lines of investigation. (auth)

19479 (EURFNR-1224, pp 233-256) CONTRIBUTION OF THE IMF TO BREEDER FUEL ELEMENT DEVELOPMENT. Thuemmler, F. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

The technologically important problems of fuel element development and their seeming solutions at present are reviewed. The Institute for Material and Solids Research of the GfK can now look back on many years of its own work in this field. The future requirements on fuel element development are analyzed. (auth)

19480 (EURFNR-1253) FAST BREEDER PROJECT. Fourth Quarterly Report, 1974. (Kernforschungszentrum Karlsruhe (F. R. Germany)). 1974. Translation of KFK-1274/4. vp. AT.

Work performed under United States-Euratom Fast Reactor Exchange Program.

Information is presented concerning fuel pin development, materials studies, corrosion tests, physics, and safety and instrumentation. (DCC)

19481 (GA-A-13565) GAS-COOLED FAST BREEDER REACTOR. Quarterly Progress Report, May 1, 1975-July 31, 1975. (General Atomic Co., San Diego, Calif. (USA)). 2 Oct 1975. Contract E(04-3)-167. 278p. Dep. NTIS $7.60.

Progress is described in the areas of development of GCFR fuel, blanket, and control elements; fuels and materials development; nuclear analysis and reactor physics for GCFR core design; development of the pressure-equalization system for GCFR fuel; structural-thermal-flow tests of core assemblies; an in-pile loop facility test program plan; reactor engineering to assess the thermal, hydraulic, and structural performance of the core and core support structure, development of reactor control-rod, shutdown-rod, and core element locking mechanisms, evaluation of the capability of PCRV internal structures for postaccident fuel containment; evaluation of the pressure-boundary integrity of the prestressed concrete reactor vessel (PCRV); reactor safety; refueling-system development; component development engineering; shielding requirements of the GCFR; and fuel-rod engineering to evaluate the steady-state and transient performance of the GCFR fuel and blanket rods. (auth)

19482 (IFA-NT-6-1975) EVALUATION OF THE FAST REACTOR EXAMPLES FOR TESTING ONE-DIMENSIONAL MULTIGROUP DIFFUSION PROGRAMS. Cuculeanu, V.; Marin, V. (Institutul de Fizica Atomica, Bucharest (Romania)). 1975. 15p. Dep. NTIS (US Sales Only) $3.50.

Results are presented concerning the calculation of fast reactor examples for testing one-dimensional multigroup diffusion equation programs. (auth)

19483 (INTAT-75.9) TESTING OF A PROTOTYPE SODIUM PUMP. Report of Full Scale Pump Tests Carried out in Support of the SNR 300 Fast Breeder Reactor Program. Mendte, K.; Reimann, H.; Fakkel, R.; Heslenfeld, M. (Internationale Atomreaktorbau G.m.b.H. (INTERATOM), Bensberg/Koeln (F. R. Germany)). Feb 1974. 73p. Dep. NTIS (US Sales Only) $5.00.

A summary is presented of a 6000-hour operational test program performed on a full-scale prototype sodium circulation pump for the SNR reactor. (auth)

19484 (ORNL-TM-5003(Suppl. 1)) TEMPERATURE DISTRIBUTION IN 19-ROD SIMULATED LMFBR FUEL ASSEMBLIES WITH AND WITHOUT AN EDGE BLOCKAGE (OUT-OF-REACTOR TEST FOR ANL SLSF P1 EXPERIMENT). Record of Experimental Data for Fuel Failure Mockup Bundles 5B and 5C. Fontana, M. H.; Gnadt, P. A.; Kress, T. S.; MacPherson, R. E.; Parsly, L. F.; Wantland, J. L. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 67p. AT.

Unevaluated experimental data obtained from Fuel Failure Mockup (FFM) bundles 5B and 5C, which simulated the configuration of the Sodium Loop Safety Facility (SLSF) P1 experiment to be conducted by Argonne National Laboratory (ANL), are presented. The bundles consisted of 19 electric cartridge heaters with outside diameters of 0.23 in. spaced by 0.056-in. wire wraps on a 12-in. pitch. At the edge of the bundles, the diameter of wire wraps was reduced to 0.028 in., so that the flow passages contiguous to the channel wall were reduced in cross-sectional area. In bundle 5B, a stainless steel blockage plate attached 4 in. downstream from the start of the heated section blocked approximately one-third of the flow cross-sectional area along two adjacent flats of the hexagonal duct. During the first portion of the test series, the blockage plate was held flush against the duct wall, while during the latter testing the blockage plate was displaced from the duct wall by 0.014 in. Bundle 5C was an identical configuration except that the blockage plate had been removed from the bundle. The purpose of this test series was to determine the efficacy of the blockage for inducing fuel failure in the SLSF P1 experiment and to preview thermal-hydraulic coolant behavior of the SLSF rod bundle. A description of the system, the experimental procedures, and tabulated data from the experiments performed in this series are included. (auth)

19485 (PB-239513) BREEDER BENEFITS AND URANIUM ORE AVAILABILITY. Special Report. Manne, A. A.; Yu, O. S. (Electric Power Research Inst., Palo Alto, Calif. (USA)). 1 Oct 1974. 38p. (EPRI-SR-3). NTIS $3.75.

The relation between economic benefits of the breeder and the availability of uranium ore resources is examined. The model has been constructed around a future role of the fast breeder reactor (FBR) in a mix of nuclear, coal, and other possible advanced concept power systems. Only a small number of variations has been calculated, making assumptions on the cost of uranium, the discount rate for R and D investments, etc. The President of EPRI recommends that, as backup to the FBR, the nation should develop an environmentally acceptable coal utilization technology. He notes that such a program is now underway, but could become a crucial necessity if uranium ore costs rise substantially, and the FBR or another advanced concept is not available in time. (GRA)

19486 (RCN-227) FAST REACTOR PROGRAM. Numerical Calculation of Temperature Fields in Rod Assemblies With Liquid Metal Cooling. Slagter, W.; Roodbergen, H. A. (Stichting Reactor Centrum Nederland, Petten). Jul 1975. 37p. INIS.

A numerical method has been applied to determine three-dimensional temperature distributions in small regions of hexagonal fuel rod assemblies with liquid metal cooling. The temperature calculations, based on the finite element method, centered on heat transport from the fuel rod surface into the adjacent subchannel and on heat transport between adjacent subchannels. The study is restricted to analysis of steady-state heat transfer in fuel rod assemblies of smooth parallel rods for the condition of prescribed heat flux and slug flow. The computed temperature profiles are expressed in terms of Nusselt or Stanton numbers and amplitudes of circumferential cladding temperature variations as a function of axial distances. In simple geometries like the circular duct, the method is applied to calculate the temperature distribution and the axial variation of the Nusselt number for the condition of laminar flow and uniform heat flux. The flow is hydrodynamically developed. Good agreement between numerical and theoretical solutions confirms the validity of the finite element method. The results obtained for fuel rod assemblies are compared with available experimental and theoretical predictions. It is found that the contribution of turbulence to intersubchannel heat transport in sodium equals that due to conduction. The novel feature of the method applied to convective heat transfer problems is the computation of detailed three-dimensional coolant temperature fields in large regions of fuel rod assemblies. (NL)

19487 (TRG-Report-2733(R)) NABUB: A NONSATURATED MODEL OF COOLANT BOILING IN A FAST REACTOR SUBASSEMBLY. Brook, A. J.; Mills, D. S. (UKAEA Reactor Group, Risley). Aug 1975. 56p. Dep. NTIS (US Sales Only) $4.50.

A theoretical model is presented of sodium boiling in a fast reactor sub-assembly in which the usual assumptions of a saturated vapour are not made. Instead, vapour pressure is calculated on a perfect gas basis, which enables some allowance to be made for the possible presence of non-condensables, which may inhibit the condensation of the vapour. Indications are given of the circumstances under which such inhibition might be expected to show the most marked effects, and some sample results obtained by the code are presented. These show that the coolant voiding pattern is most sensitive to restrictions on the condensing flux in the 100 to 200 w/cm^2 range. If unrestricted condensation is assumed, the results of the code are in excellent agreement with more conventional saturation models. 7 references. (auth)

19488 STUDY OF MASS TRANSFER BY LIQUID SODIUM IN CLOSED LOOP SYSTEMS. Sodium Technology Development Program. Kolster, B. H. The Hague; Nijverheidsorganisatie TNO (1974). 29p.

From information meeting TNO contribution to LMFBR development; Utrecht, Netherlands (10 May 1973).

Results of a research program on mass transfer phenomena by liquid sodium are reported. Concerning corrosion, results are presented of investigations of the influence of temperature, oxygen level, and downstream position on the corrosion behavior of a stainless steel 316 specimen. A brief summary of a model and a derivation of the corrosion rate expression is given. For deposition the same parameters as for corrosion are studied. Specimens were extensively investigated by means of a combination of metallographic techniques. In order to eliminate the influence of the loop material on the mass transport, a loop will be built using molybdenum for construction material. Decarburization studies are carried out and it is concluded that heat treatment and an addition of certain amounts of niobium and chromium have a stabilizing effect on the decarburization of specimen materials. (NL)

19489 FIRST NUCLEAR POWER PLANTS AND THE PRESENT PATTERN OF DEVELOPMENT OF NUCLEAR POWER. Krasin, A. K. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 2, 5-10(1974). (In Russian)

The perspectives of nuclear power engineering development, the problem of the design of fast breeder-reactors with short doubling time which satisfy the demands of reliability, safety, and profitability are described. The advantage of gas-cooled breeder reactors concepts in comparison with sodium-cooled fast reactors is presented. (auth)

19490 START-UP OF NUCLEAR POWER PLANTS. Sharovarov, G. A.; Shadskii, V. M.; Skurat, V. V.; Mitei, N. V.; Mikhailova, T. A. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 3, 5-11(1974). (In Russian)

The features of the heating and startup systems of the nuclear power plants with dissociating gas as a coolant are discussed. The heating and starting technology of the nuclear power plants as well as the investigation method of starting regimes are offered. (auth)

19491 FISSION GAS BEHAVIOR IN OXIDE FUEL ELEMENTS OF FAST BREEDER REACTORS. Zimmermann, H. (Kernforschungszentrum, Karlsruhe, Ger.). Nucl. Technol.; 28: No. 1, 127-133(Jan 1976).

The fission gas behavior in oxide fuel elements irradiated within the irradiation program of the Fast Breeder Project was determined. The amount of fission gas was measured in three steps as released fission gas, fission gas retained in bubbles and pores, and fission gas retained in the fuel matrix. This was done by the puncturing of the fuel rods, by the grinding of the fuel, and by the chemical solution of the powdered fuel, respectively. Under the conditions prevailing in fast breeder reactors, the fractional fission gas release is 90 percent or more after medium and high

burnups. The release rate is not constant, but there are periods with particularly high release rates (breakaway release). The retained fission gas reaches concentrations of 1.5×10^{-2} gas atoms per uranium and plutonium atoms in fuel regions with temperatures below 1100°C. The concentration decreases with increasing temperatures. At temperatures above 1500°C the concentration of the retained gas is 2×10^{-4} gas atoms per initial metal atom. Up to five times more fission gas is retained in bubbles and pores than in the matrix. There is a relation between plastic deformation of the cladding by mechanical interaction with the fuel and the concentration of fission gas in bubbles. (auth)

19492 STATISTICAL AND METALLURGICAL ANALYSES OF EXPERIMENTAL MARK-IA DRIVER FUEL ELEMENT CLADDING FAILURES IN THE EXPERIMENTAL BREEDER REACTOR II. Olson, N. J.; Walter, C. M.; Beck, W. N. (Argonne National Lab., Idaho Falls, Idaho). Nucl. Technol.; 28: No. 1, 134-151(Jan 1976).

A reasonably large number (39) of Mark-IA driver fuel cladding failures have been obtained from run-to-failure experiments in the Experimental Breeder Reactor II over the past few years. These experiments were designed to yield failure information for various design variables and to qualify the fuel element design to a burnup limit such that the risk of an end-of-design-life failure was exceedingly small for normal operating conditions. None of the design variables or operating conditions tested had a significant effect on the failure statistics. (auth)

19493 CLINCH RIVER BREEDER REACTOR BREEDING CHARACTERISTICS. Tillett, G. C. Jr.; Buhl, A. R. (Energy Research and Development Administration, Washington, DC). Nucl. Technol.; 28: No. 1, 92-97(Jan 1976).

The compound system doubling time of the Clinch River Breeder Reactor has been evaluated for a broad range of breeding ratios and fuel cycle parameters. Reprocessing plant fissile inventory and fissile losses due to incomplete fuel recovery are shown to have a strong influence on the doubling time when the breeding ratio is low. If the breeding ratio is above 1.2, fissile losses are much less significant and acceptable doubling times are achieved. (auth)

19494 DEVELOPMENT OF THE FAST BREEDER REACTOR. Carle, R.; Megy, J.; Vendryes, G.; Banal, M.; Saitcevski, B.; Moreau, M. J. C.; Rozenholc, M. pp Paper 4.1-4, 20p. of 9th World Energy Conference. London; World Energy Conference (1974). (In French)

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-P4.

19495 FAST-POWER-REACTOR OPTIMIZATION BY THE GAME THEORY. Pavelescu, M.; Dumitrescu, H.; Adam, S. (Inst. for Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 6, 597-609(1975).

In the first stage of the use of fast breeder reactors—because fissile-material amounts are small—we are interested in fast breeder reactors which achieve minimum fissile-material mass with maximum power. This problem shows a two-matrix-game structure. First, we determine a competitive-game solution and second, a cooperative-game solution, obtaining in this way the optimum distribution of the fissile and fertile materials in the multizone fast reactors. Another optimization problem which is solved is finding the reactor structure for which the power nonuniformity factor and the flux nonuniformity factor are minimum. This is, also, a mathematical two-matrix game and it is solved as above. (auth)

19496 ANALYTICAL STRESS ANALYSIS SOLUTION FOR A SIMPLIFIED MODEL OF A REACTOR FUEL ELEMENT. Lamkin, D. E. (Texas A and M Univ., College Station); Brehm, R. L. Nucl. Technol.; 27: No. 2, 273-285(Oct 1975).

An exact closed-form solution for the stresses and strains in an idealized nuclear reactor fuel pin under operational conditions is presented. The fuel is considered as a single region, either solid or annular, which may or may not interact with the surrounding cladding, depending on initial fuel-cladding gap and subsequent reactor operating parameters. Temperature-dependent thermal conductivity and irradiation swelling and temperature-independent creep in both fuel and cladding are allowed. 18 references. (auth)

19497 ANALYSIS OF PRESSURE PULSE GENERATION DUE TO GAS RELEASE FROM FAILED FUEL PINS IN A LIQUID-METAL FAST BREEDER REACTOR. Kazimi, M. S. (Brookhaven National Lab., Upton, NY). Nucl. Sci. Eng.; 59: No. 1, 1-11(Jan 1976).

A model for the analysis of pressure pulse generation due to sudden gas release from failed pins in a liquid-metal fast breeder reactor is presented. The predictions of the model are compared to experimental data on sudden gas release in the ducts of the Experimental Breeder Reactor II. The predicted magnitudes of pressure pulses are in good agreement with the experimental observations. The predicted pressure pulse, however, seems to decay at a faster rate than the experimentally observed rate. The effects of the pin internal pressure upon rupture, the rupture area, and the amount of compressed gas are studied parametrically. The pressure pulse magnitude is found to be more sensitive to the internal pin pressure upon rupture than to either the rupture area or the compressed gas volume. (auth)

19498 SHIELD PLUG ACCESS ENCLOSURE FOR A NUCLEAR REACTOR. Sutherland, J. P. (to Westinghouse Electric Corp.). US Patent 3,920,512. 18 Nov 1975. Filed date 17 Apr 1973. 6p.

A description is given of a shield plug of a liquid metal cooled fast breeder reactor which uses a hot cell refueling system and has a metal access enclosure sealed to its upper surface. The enclosure contains the control rod drive mechanisms, reactor closure bolts and other components as are generally mounted on a shield plug, and an air atmosphere is provided within the enclosure. A horizontally extending bellows-like structure allows personnel access to the enclosure from the exterior of the hot cell. (Official Gazette)

19499 CRITERIA FOR COMMERCIAL FAST REACTORS. Electr. Rev.; 197: No. 18, 564-565(31 Oct 1975).

The present status of nuclear power is very briefly examined. An analysis is made of the opening address of J. C. C. Stewart to the Nuclex exhibition in which is advocated the construction of several "precommercial" stations as a prerequisite to full commercial dealing in fast reactors. (UK)

19500 NUCLEAR REACTOR INSTRUMENTATION. Duncombe, E.; McGonigal, G. (to United Kingdom Atomic Energy Authority). US Patent 3,922,192. 25 Nov 1975. Priority Date 1 Nov 1972, United Kingdom of Great Britain and Northern Ireland (UK). 4p.

A liquid metal cooled nuclear reactor is described which has an equal number of fuel sub-assemblies and sensing instruments. Each instrument senses temperature and rate of coolant flow of a coolant derived from a group of three sub-assemblies so that an abnormal value for one sub-assembly will be indicated on three instruments thereby providing for redundancy of up to two of the three instruments. The abnormal value may be a precurser to unstable boiling of coolant. (Official Gazette)

Research, Test, and Experimental Reactors

Refer also to abstracts 17618, 19535, and 19613.

19501 (EURFNR-1224, pp 207-220) IRRADIATION PLANTS. Bojarsky, E.; Deckers, H.; Haefner, H.; Lehning, H.; Reiser, H.; Schmidt, L. Sep 1974. Translated from KFK-1999.

In papers concerning fuel element development for the fast breeder reactor SNR-300.

The various in-pile experiments carried out for the SNR fuel element development can be roughly divided up as follows: a first large group which covers basic investigations and parameter tests on cladding material, fuels and fuel pins; and a second group containing the performance tests on fuel pins and clusters up to the SNR actual size. The experiments of the first group, of a mainly basic character, can be performed in thermal research and material-testing reactors, i.e., in the German FR-2 and the Belgian BR-2. A number of irradiation installations for these reactors are described. (auth)

19502 (HEDL-TME-75-86) EBR-II 75D, HIGH POWER DOSIMETRY TEST. Lippincott, E. P.; Ulseth, J. A.; Kellogg, L. S.; Davis, A. L.; McElroy, W. N. (Hanford Engineering Development Lab., Richland, Wash. (USA)). Dec 1975. Contract E(45-1)-2170. 40p. Dep. NTIS $4.25.

Preliminary analysis has been completed for twelve midplane sets irradiated in the EBR-II Run 75D high power dosimetry test. Results indicate changes that have occurred in the EBR-II core environment since previous dosimetry test measurements made before the substitution of the stainless steel reflector for the depleted uranium blanket. Large flux variations were also noted outside the core depending on the composition (fuel vs. structural) of neighboring core subassemblies. (auth)

19503 (LMEC-75-10(Vol.1)) FFTF SIV QUALIFICATION TEST PROGRAM. Volume I. Description and Results. Miller, D. B. (Liquid Metal Engineering Center, Canoga Park, Calif. (USA)). 15 Aug 1975. Contract AT(04-3)-700. 139p. AT.

A comprehensive test program was conducted on the FFTF 8-in. Secondary Isolation Valve (SIV) to qualify its use in the FFTF sys-

tem. The tests were performed in the Small Components Test Loop/Piping and Valve Test Insert (SCTL/PVTI) facility at the Liquid Metal Engineering Center (LMEC). Testing has included thermal transients, mechanical cycling, leak checks, flow tests, and operator performance. Physical inspections were conducted in the presodium condition and are planned for the post-sodium condition. (auth)

19504 (ORNL-5046, pp 57-58) HEALTH PHYSICS RESEARCH REACTOR AND ACCELERATOR OPERATIONS. Ward, D. R.; Haywood, F. F.; Holland, L. B.; Dickson, H. W.; Jackson, J. E.; Fox, W. F.; Littleton, C. P. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

The Health Physics Research Reactor (HPRR) continues to play an important role in the efforts to correlate radiation dose with biological effects. In addition, the HPRR is also used for nuclear engineering studies and for nuclear safety through the dosimetry intercomparison studies, which are designed to evaluate nuclear accident dosimetry systems. Most of the operation of the DOSAR Low Energy Accelerator has continued in support of an experiment designed to determine the stopping of protons, in the energy range of 50 to 150 keV, in tissue-constituent gases. (auth)

19505 (ORNL-TM-4446) CALCULATIONS OF COOLANT-PIPE NEUTRON STREAMING AND SECONDARY COOLANT ACTIVATION IN THE FAST FLUX TEST FACILITY. McGregor, B. J.; Abbott, L. S. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 53p. AT.

Two series of calculations were performed with the DOT discrete ordinates code in two-dimensional cylindrical geometry to predict the neutron streaming along the sodium coolant pipes of the Fast Flux Test Facility to the heat exchanger vault. The results were used to predict the sodium activation that could be expected in the heat exchanger, the criterion for the secondary loop sodium being a maximum of 0.06×10^{-9} Ci/cm^3. The first DOT study was performed in the fall of 1972 for the then-current design of the coolant system for the 28-in.-diam pipe penetrations; the second study was performed in February of 1973 for a later design of both the 28-in. pipe and the 16-in.-diam pipe penetrations. The second study was backed up with a few Monte Carlo calculations performed for more realistic three-dimensional geometries to determine the validity of using the symmetrically cylindrical geometry in the DOT calculations. The results indicated that the DOT calculations were conservative and that even with a factor of 10 uncertainty allowed for the full calculation, the sodium activation in the heat exchanger vault would be less than one-third of its allowed value. (auth)

19506 MEASUREMENT OF THE FAST NEUTRON SPECTRUM IN FAST-THERMAL CRITICAL ASSEMBLIES. Bychkov, M. V.; Skobkarev, A. V. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 3, 12-16(1974). (In Russian)

The possibility of fast neutron spectra measurements by threshold in the fast-thermal critical assembly is shown. Use has been made of the following reactions ^{103}Rh(n, n') ^{103m}Rh, ^{115}In(n, n')^{115m}In, ^{58}Ni(n, p)^{58}Co, ^{64}Zn(n, p)^{64}Cu, ^{56}Fe, ^{27}Al(n, α)^{24}Na. From the activation data the energy distribution of fast neutrons was calculated by means of the least square-method using the BESM-3M computer and by the express method. (auth)

19507 POWER BURST FACILITY FUEL STUDIES. Cole, J. T. (Aeroject Nuclear Co., Idaho Falls, ID); Wood, R. E. Nucl. Technol.; 28: No. 1, 9-22(Jan 1976).

The Power Burst Facility (PBF) is designed to operate under steady-state conditions to 20 MW (this value may be upgraded to 30 to 40 MW in the near future), with self-limiting power bursts having initial asymptotic periods as short as 1.3 msec, and with shaped power bursts. The core and thus the fuel rods to accomplish these design requirements involved a significant development program to determine the performance capability. The limiting performance capability was determined to be the axial and diametral growth of the fuel rods. The growth behavior of the fuel rods resulted from burst tests conducted in the Transient Reactor Test Facility and Capsule Driver Core reactors. In these tests, the fuel rods were subjected to repeated bursts (10 to 200 bursts/rod) in which fuel temperatures ranged from 1600 to approximately 2600^{0}C. The minimum reactor period was 3.0 msec. The PBF fuel rods, which are 47.5 in. long and 0.75 in. in diameter, experienced maximum axial growth on the order of 0.75 in. and maximum diametral growth of approximately 0.040 in. in these tests. (auth)

19508 (U,Zr)C-GRAPHITE FUEL FOR TREAT CONVERTER STUDIES. Davidson, K. V. (Los Alamos Scientific Lab., NM). Nucl. Technol.; 28: No. 1, 23-30(Jan 1976).

Improved test facilities are required for safety studies of liquid-metal fast breeder reactor (LMFBR) fuel bundles. The objectives for such a test facility can be obtained by installing a converter section in the central region of the Transient Reactor Test Facility (TREAT) core to provide a hardened neutron spectrum around the test section containing the large cluster of LMFBR fuel pins. The expertise gained at Los Alamos Scientific Laboratory in the Rover fuel element development program was extended to fabricate (U, Zr)C-graphite composite fuel rods for scoping studies of candidate fuels. Selected properties determined for the carbide-graphite composite fuel rods provided for the first scoping test indicate that they are definitely a candidate fuel for a TREAT converter. (auth)

19509 FUEL ELEMENTS FOR PULSED TRIGA RESEARCH REACTORS. Simnad, M. T.; Foushee, F. C.; West, G. B. (General Atomic Co., San Diego, CA). Nucl. Technol.; 28: No. 1, 31-56(Jan 1976).

TRIGA fuel was developed around the concept of inherent safety. A core composition was sought that had a large prompt negative temperature coefficient of reactivity such that if all the available excess reactivity were suddenly inserted into the core, the resulting fuel temperature would automatically cause the power excursion to terminate before any core damage resulted. Experiments have demonstrated that zirconium hydride possesses a basic neutron-spectrum-hardening mechanism to produce the desired characteristic. Additional advantages include the facts that ZrH has a good heat capacity, that it results in relatively small core sizes and high flux values due to the high hydrogen content, that it has excellent fission-product retentivity and high chemical inertness in water at temperatures up to 100^{0}C, and that it can be used effectively in a rugged fuel element size. Tens of thousands of routine pulses to the range of 500 to 800^{0}C peak fuel temperatures have been performed with TRIGA fuel, and a core was pulse-heated to peak fuel temperatures in excess of 1100^{0}C for hundreds of pulses before a few elements exceeded the conservative tolerances on dimensional change. (auth)

19510 MATERIAL PROPERTY DETERMINATION FOR FAST PULSED REACTOR FUELS BY RAPID FISSION HEATING. Reuscher, J. A.; Schmidt, T. R. (Sandia Labs., Albuquerque, NM). Nucl. Technol.; 28: No. 1, 57-67(Jan 1976).

A new experimental technique has been developed for dynamically measuring the thermomechanical properties of fissile materials. The speed of sound, modulus of elasticity, and coefficient of thermal expansion as a function of temperature for uranium alloys can be determined using the heating conditions that exist in a fast pulsed reactor. The technique was developed to provide thermomechanical property data for pulse reactor fuels under actual use conditions. (auth)

19511 MEASUREMENT OF TEMPERATURE-DEPENDENT INTERNAL FRICTION FOR URANIUM, U-0.78 WT PERCENT Ti, U-6 WT PERCENT Mo, AND U-10 WT PERCENT Mo. Laats, E. T. (Idaho State Univ., Pocatello); Schmidt, T. R.; Reuscher, J. A. Nucl. Technol.; 28: No. 1, 68-76(Jan 1976).

Experiments have been performed recently at Sandia Laboratories to investigate and characterize potential fuel materials for fast burst reactors. A novel technique has been developed to determine the thermomechanical properties of fuel materials under actual use conditions. The Sandia Pulsed Reactor II is used to rapidly fission heat a thin rod of the sample material, supported at its center, thereby inducing longitudinal stress waves in the sample. The dilation history at the ends of the rod and the temperature of the rod are recorded. A measure of the internal friction is determined from the decay of the longitudinal oscillations induced in the sample. The materials examined include uranium, U-0.78 wt percent Ti, U-6 wt percent Mo, and U-10 wt percent Mo. The first two are alpha-phase materials in a wrought condition, while the second two are gamma-phase-stabilized materials in an "as cast" condition. The alpha-phase wrought materials had higher internal friction than the gamma-phase "as cast" materials, with uranium being the highest by approximately two orders of magnitude as compared to U-10 wt percent Mo, the lowest. (auth)

19512 FABRICATION OF URANIUM-MOLYBDENUM ALLOY FUELS FOR PULSED REACTORS. Taub, J. M. (Los Alamos Scientific Lab., NM). Nucl. Technol.; 28: No. 1, 77-86(Jan 1976).

The use of pulsed reactors for the evaluation of reactor materials and components has been on the increase, and pulsed reactors to handle large components are under consideration. Pulsed reactors currently operate at a 30 to 50 mu sec pulse width and a neutron yield of 5×10^{16} fission/pulse; improved capability would move toward even smaller pulse widths and neutron yields in the 10^{17} fission/pulse range. The gamma phase U-10 Mo alloy with highly enriched uranium has been the fuel alloy used in most pulsed reactors. The fabrication of U-10 Mo alloy fuel plates for

the new SPR-III reactor at Sandia Laboratories, Albuquerque, New Mexico, required a detailed review of all processing operations because of the highly enriched uranium and the related criticality considerations. It was necessary to cast the maximum allowable mass of highly enriched uranium (36 kg) in order to make a single fuel plate. The low carbon impurity level specified was obtained with the formulation of a new and highly successful composite coating material for graphite crucibles and molds. The plate distortions which occur in water quenching the alloy from the 950°C gamma phase to room temperature were eliminated by quenching between cold platens in a hydraulic press. Typical mechanical properties obtained on cast, heat treated plates were 930 MPa yield strength, 940 MPa tensile strength, 12.9 percent elongation in 25.4 mm, and 35.4 percent reduction in area. (auth)

19513 SUMMARY OF UNPUBLISHED PRESENTATIONS FOR FUELS FOR PULSED REACTORS. Horak, J. A. (Oak Ridge National Lab., TN). Nucl. Technol.; 28: No. 1, 87-91(Jan 1976).

Information is presented on fuels for the IBR-2 reactor, the TREAT converter fuel element studies, the ACPR reactor fuel modifications, and the fuel elements to provide high fluence pulses in the VIPER reactor. (DG)

19514 TWO-REGION ANALYSIS OF PULSING DATA IN FAST CRITICAL SYSTEMS. Brunson, G. S.; Huber, R. J. (Argonne National Lab., Idaho Falls, Idaho (USA)). Nucl. Instrum. Methods; 128: No. 2, 379-403(1 Oct 1975).

Pulsed neutron die-away experiments were performed in three fast critical systems assembled in the Argonne Zero Power Reactor-III (ZPR-III). These experiments were part of a comprehensive study of the mockups of the proposed fast reactors FARET (Fast Reactor Test) and SEFOR (Southwest Experimental Fast Oxide Reactor). The two FARET systems pulsed were Assembly 46-B, a 68 liter plutonium–uranium carbide core with stainless steel and sodium reflector; and Assembly 46-C, an 87 liter plutonium–uranium oxide core with the same reflector materials. The SEFOR mockup was a 528 liter plutonium-depleted uranium oxide core with a reflector of stainless steel, sodium and nickel. In all three cases, an acceptable analysis of the die-away curves required two exponentials plus background. From this data, it was possible to assign, by a two-region transfer function analysis, a prompt neutron lifetime to core neutrons and to the system as a whole. Further, the transfer function model used predicts that the die-away curves in the reflector will contain two exponential terms having the same two exponential decay constants as were found in the core, and that the coefficient of the faster decay will be negative. This was found to be the case within experimental uncertainty. (NL)

19515 EXPERIMENTS WITH THE KEMA SUSPENSION TEST REACTOR RUNNING AT FULL CAPACITY. Kersten, J. A. H. Atoomenerg. Haar Toepass.; 17: No. 11, 234-236(Nov 1975). (In Dutch)

The results of various conventional tests with this 1000 kW experimental reactor (KSTR) are shown in diagrams. The comparatively high negative temperature coefficient of the reactivity was found to be a great advantage. Some inexplicable temperature differences and temperature changes in the reactor vessel were found. (NL)

19516 EFFECTIVITY OF HYDROGENEOUS MODERATORS IN PULSED SOURCES. Rief, H.; Hartman, J. (Commission of the European Communities, Ispra, Italy). Ann. Nucl. Energy; 2: No. 7/8, 521-539(Aug 1975).

Guide lines are provided for an evaluation of the potential of pulsed reactors. In the SORA reactor, neutrons emitted from the fast core are converted in hydrogeneous moderators to beams of low energy neutrons for time of flight experiments. The important characteristics of the neutron sources are absolute intensity of the neutron beam and its energy and time distribution. The problem is solved mathematically by the random walk (Monte Carlo) method. Calculational methods which are described are compared with pulsed moderator measurements. The choice of moderators and criteria of optimization are discussed. Particular examples of realistic moderator design as planned for SORA, and as they will be used in pulsed reactors, are analyzed, a distinction being made between thermal, cold, and hot moderators. Finally flux estimates are compared with those obtained for a spallation target. (UK)

Production and Materials Testing and Processing Reactors

19517 RADIATION OUTPUT FROM THE $^{10}B(n,\alpha)^{7}Li$ REACTION IN CHANNELS OF THE RADIATION CHEMICAL LOOP. Kashcheev, V. P.; Litvinenko, B. A. (Inst. of Nuclear Energy, Minsk). Vestsi Akad. Navuk BSSR, Ser. Fiz.-Energ. Navuk; No. 2, 15-17(1974). (In Russian)

Radiation power levels were estimated by using the energy of the $^{10}B(n,\alpha)^{7}Li$ reaction in radiation chemistry loops of the Byelorussian research reactor IRT-R. (auth)

Propulsion and Package Reactors

Refer also to abstracts 17598, 17610, 17687, and 19609.

19518 (CNLM-433) [PRELIMINARY STUDIES OF NUCLEAR RAMJETS]. Meyer, R. M. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 19 Dec 1957. 6p. Dep. NTIS $3.50.

Declassified 14 Jan 1976.

Specifications for nuclear ramjet propulsion systems are listed. (DCC)

19519 (CNLM-2307(Suppl.1)) ENGINEERING PROPOSAL FOR SUPPORT OF ADDITIONAL RESEARCH AND DEVELOPMENT WORK ON MATERIALS AND PROPULSION EQUIPMENT COMPONENTS OF AIRCRAFT NUCLEAR PROPULSION SYSTEMS. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 18 Mar 1960. 9p. Dep. NTIS $3.50.

Declassified 8 Dec 1975.

Proposed research and development work is outlined concerning powerplant performance analysis, engine components, radiators, materials, liquid metal system components, instrumentation, and controls. (DCC)

19520 (CNLM-2644) HE-12CL TEST HEAT EXCHANGER. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). [nd]. 3p. Dep. NTIS $3.50.

Specifications for the HE-12CL heat exchanger are presented. (DCC)

19521 (CNLM-3143) DEVELOPMENT PLAN FOR NJ-18A POWER PACKAGE GROUND TEST PROGRAM 1961–1965. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 24 Jan 1961. Contract AT(11-1)-229. 189p. Dep. NTIS $7.50.

Declassified 12 Jan 1976.

Plans for the engineering and development, including initial testing, of an indirect cycle nuclear propulsion system suitable for the Convair NX 2 airplane are presented. (JWR)

19522 (CNLM-3550) DISCUSSION OF LIQUID METAL SYSTEM INTEGRITY AND AIRCRAFT SHIELDING QUESTIONS. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 22 Mar 1961. 12p. Dep. NTIS $3.50.

Declassified 12 Jan 1976.

The design, fabrication, and development of the NJ-18 power package is being conducted in order to eliminate possible liquid metal leaks. However, should an inadvertent leak occur, provisions to handle the problem are designed into the system: (1) secondary containment around all liquid metal components, (2) damage control valves, (3) leak detection systems, (4) liquid metal dump systems, (5) fire barriers, (6) jet engines capable of operation on both jet fuel and nuclear power, (7) two reactors, only one of which is required to supply the airplane full thrust requirement at cruise, and (8) four engines, only two of which are required to fly the airplane in an emergency. Nuclear powered aircraft shielding studies of the liquid metal cycle show that large shielded payload compartments are possible with relatively low radiation dose levels emanating from the powerplant reactor shield for subsonic aircraft. Large shielded payload compartments are possible for supersonic aircraft; however, higher radiation dose levels must be accepted outside the reactor shield. (auth)

19523 (CNLM-4251) TRANAL II: AN IBM704 FORTRAN CODE FOR THE CALCULATION OF REACTIVITY VERSUS PERIOD FROM ROD-DROP EXPERIMENT DATA. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 21 Sep 1962. Contract AT(30-1)-2789. 21p. Dep. NTIS $3.50.

19524 (CNLM-5195) PORTABLE COMPACT NUCLEAR POWERPLANT USING THE LCRE REACTOR. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 16 Sep 1963. Contract AT(30-1)-2789. 56p. Dep. NTIS $4.50.

Declassified 3 Nov 1975.

One of the more promising applications for a compact, high temperature reactor of the Lithium-Cooled Reactor Experiment

(LCRE) type is a portable electric power generating system. This preliminary study was based upon a powerplant of the Army portable type having a net electrical power output of 1000 kW(e). The LCRE reactor would be used as a heat source to operate the gas turbine engines of the power conversion system. The powerplant concept described utilizes a compact, lightweight, liquid metal system which appears ideally suited to a portable nuclear powerplant application. Due to the lightness of this system, it is possible to remove the entire reactor and primary liquid metal system intact and replace it with a new unit. Opening of the reactor circuit and replacing fuel elements after the reactor has reached its useful lifetime limit is not, therefore, performed as such. Furthermore, the use of a modified aircraft engine permits operation on chemical fuel, using the installed electrical generators, while the system is not operating on nuclear heat. The design objectives for this study are summarized. To minimize development time and costs, only those components are used which have been tested or are scheduled to be tested, or will be vendor-supplied. The LCRE reactor was being developed by CANEL and was scheduled to be operational late in 1965. Before completion of this study, CANEL was directed by the AEC to discontinue fabrication of the LCRE components and reorient the design to a prototype reactor for space operation. (auth)

19525 (CNLM-5254(Rev.1)) SNAP-50 FUEL IRRADIATION DATA. Freed, M. S. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 30 Sep 1963. Contract AT(30-1)-2789. 3p. Dep. NTIS $3.50.

Declassified 5 Nov 1975.

Irradiation data for SNAP-50 fuel pins of UO_2, UC, and UN are listed. (DCC)

19526 (CNLM-5275) PRESENTATION OF ADAPTING THE SNAP-50 SPACE POWERPLANT TO A LUNAR BASE. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 4 Oct 1963. Contract AT(30-1)-2789. 29p. Dep. NTIS $4.00.

Declassified 4 Nov 1975.

The illustrations which were used in the Pratt & Whitney Aircraft-CANEL presentation of adapting the SNAP-50 space powerplant to a lunar base were presented. Part I contains the illustrations which were used for the basic presentation and Part II contains those illustrations which were used as supplemental information for additional elaboration. (auth)

19527 (CNLM-5469) COMMENTS ON WESTINGHOUSE-ASTRONUCLEAR LUNAR BASE STUDY. Interim Report. (Pratt & Whitney Aircraft, Middletown, Conn. (USA)). 20 Jan 1964. Contract AT(30-1)-2789. 5p. Dep. NTIS $3.50.

Declassified 3 Nov 1975.

The adaption of a temperature-derated SNAP 50/SPUR system to a lunar base is discussed. (JWR)

19528 (CNLM-5689(Rev.1)) PRELIMINARY PROPOSAL FOR THE CONTINUATION OF RANKINE CYCLE SPACE BOILER DEVELOPMENT PROJECTS. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 4 Jun 1964. Contract AT(30-1)-2789. 53p. Dep. NTIS $4.50.

Proposals for the continuation of 5 projects associated with the development of a Rankine-cycle space boiler are presented. (JWR)

19529 (CNLM-6056) MINUTES OF NOVEMBER 20, 1964, MEETING WITH AIRESEARCH MANUFACTURING COMPANY TO DISCUSS TURBOALTERNATOR DESIGN CONCEPTS. (Pratt and Whitney Aircraft, Middletown, Conn. (USA)). 21 Dec 1964. 5p. Dep. NTIS $3.50.

19530 (NASA-CR-54440) INVESTIGATION OF CAVITATION DAMAGE OF A MECHANICAL PUMP IMPELLER IN HIGH TEMPERATURE POTASSIUM. Quarterly Progress Report No. 2, March 1, 1965–July 2, 1965. Kulp, R. S.; Altieri, J. V. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 12 Jul 1965. 22p. (CNLM-6031). Dep. NTIS $3.50.

During this quarter water calibration of the RI-7B3 impeller has been completed. The results check closely with data obtained from the RI-7A3 impeller tests. Design work on the KP-1 turbopump and the Liquid Metal Pump Test Stand has been completed. Fabrication of parts for the turbopump has been completed, and the pump has been assembled. A water test of the turbopump in the Liquid Metal Pump Test Stand has been completed. Radial forces on the impeller have been determined to exist and their magnitude calculated. A two hour acrylic lacquer test run has been completed. (auth)

19531 (NASA-CR-54785) BRAYTON-CYCLE TURBOMACHINERY ROLLING-ELEMENT BEARING SYSTEM. First Quarterly Report. Means, H. (Pratt and Whitney Aircraft, East Hartford, Conn. (USA)). Oct 1965. 78p. (PWA-2713). Dep. NTIS $5.00.

The work completed during the first three months of a design and experimental program formulated to investigate the potential of oil-lubricated rolling-element bearings for Brayton-cycle space power machinery is reviewed. A basic bearing-seal lubrication, scavenge, and separation system concept adaptable to the turbomachinery being developed on Contracts NAS3-4179 and NAS3-6013 was evolved. Mechanical design work was initiated on both the turbine-compressor and the turboalternator to replace the gas bearing rotor support system with an oil-lubricated rolling-element bearing system. A detailed design analysis was made to define the geometry of the rolling-element bearings for the turbine-compressor. Lubricant evaluations were initiated to form a basis for selection of the optimum lubricant for the Brayton-cycle working fluid (argon) were studied to establish limiting oil contamination criteria. (22 references.) (auth)

19532 (FPS-C-15) PRELIMINARY SPECIFICATION FOR THE JTN-9 MAIN ENGINE FUEL PUMP. (Pratt and Whitney Aircraft, East Hartford, Conn. (USA)). [nd]. 7p. Dep. NTIS $3.50.

Declassified 9 Dec 1975.

Design requirements are presented for an engine driven fuel pump for the JTN-9 main engine fuel system. (auth)

19533 (NAA-SR-TDR-8301(Suppl. 1)) BIBLIOGRAPHY, SNAP PROGRAM REPORTS, MEMO'S, TDR'S, AND MOTION PICTURES, JANUARY 1, 1966–SEPTEMBER 30, 1967. (Atomics International Div., Canoga Park, Calif. (USA)). 11 Oct 1967. 46p. Dep. NTIS $4.00.

Reactor Safety and Environmental Aspects

Refer also to abstracts 19573 and 19583.

19534 (BMI-1940) REACTOR SAFETY PROGRAM APPLICATIONS AND COORDINATION. Task 1. Steam-Water Mixing Program and System Hydrodynamics. Quarterly Progress Report, July–September 1975. Cudnik, R. A.; Flanigan, L. J.; Denning, R. S. (Battelle Columbus Labs., Ohio (USA)). Nov 1975. Contract W-7405-eng-92. 30p. Dep. NTIS $4.50.

Experimental studies are described which are being conducted to extend the understanding of steam-water interaction phenomena and processes associated with a loss-of-coolant accident. Estimates were made of the degree of steam condensation within the $\frac{1}{15}$-scale, transparent vessel model during penetration studies conducted with and without cold leg steam. The estimates indicated a high degree of steam condensation within the model. The relationship between water penetration to the lower plenum and annulus pressure loss was investigated to assess and quantify, to the extent possible, the effect of ECC water in the annulus on the resistance to reverse core steam flow of the flow system consisting of the power plenum, downcomer annulus, and broken leg. A preliminary correlation for the penetration data obtained without cold leg steam has been obtained and compared with the experimental data. The correlation relates the water penetration to the reverse core steam flow rate, the ECC injection rate, and the ECC water subcooling. The effect on penetration of operating with cold leg steam was quantified. (auth)

19535 (BNWL-B-451) CRITICALITY SAFETY REVIEW OF FFTF INTERIM DECAY STORAGE TANK. Howes, B. W.; Durst, B. M.; Lewallen, M. A.; Brown, C. L. (Battelle Pacific Northwest Labs., Richland, Wash. (USA)). Oct 1975. Contract E(45-1)-1830. vp. Dep. NTIS $4.00.

The Interim Decay Storage tank (IDS) will be located in a concrete cell in the FFTF reactor building. The tank will have capacity to store 112 driver fuel assemblies and 10 test assemblies in sodium. A criticality safety analysis for the design of the IDS tank was performed. From the analysis, it is concluded that under normal operating conditions and minor abnormal conditions that might shift the fuel, the IDS tank will remain adequately subcritical. (auth)

19536 (DP-Report-789) SAFETY ASPECTS OF HIGH TEMPERATURE REACTOR SYSTEMS. Colloquium, OECD, Paris, 24–25 November 1971. Dragon Project. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment). Apr 1972. 517p. (CONF-711163-). Dep. NTIS (US Sales Only) $29.00.

Separate abstracts are presented for each of the 17 papers presented concerning HTGR reactor safety. (DCC)

For abstracts of individual papers see: 19444–19448 and 19537–19548.

19537 (DP-Report-789, pp 40-45) DRAGON REACTOR SAFETY PHILOSOPHY CHANGES. Chapman, B. G.; Cullington, G. R. (Atomic Energy Establishment, Winfrith, Eng.). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

The way in which the safety philosophy of Dragon has changed over fifteen years has been reviewed. The change from bare fuel to coated particles has been the main contributor to these changes. The others have been associated with the layout of the circuit and the understanding over the last five to six years of fracture mechanics of steel pressure vessels. The outstanding problem which is not adequately understood is the way in which fission products, notably iodine, which have been released from the particles, migrate from their various resting places and may be released under conditions of exposure to large quantities of moisture and/or air. All the advantages of a ceramic core must be allowed to contribute to the safety of the core under transient temperature conditions and arbitrary limits should not be applied to such accidents. Dragon experience indicates that short term operation at 2000°C is not harmful. (auth)

19538 (DP-Report-789, pp 97-112) REFERENCE CORE CHEMISTRY. Kinsey, D. V. (Atomic Energy Establishment, Winfrith, Eng.). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

For the Dragon Reactor the complex problem of depressurisation of the reactor coupled with consequent tube fracture and water ingress has been studied. This leads to the assessment of the explosion hazard caused by water-gas/air mixtures in the containment building. The fact that this double event was considered at all arose from the occurrence of rapid water-side corrosion of the heat exchanger tubes in conditions unique to this reactor. The effects of in-leakage over a range from 5 kg/s to 100 kg/s are examined, employing the dimensions, ratings and temperatures for the reference core. The objectives were to estimate the concentrations of hydrogen, carbon monoxide, steam and helium in the circuit at any time after the incident, to calculate the instantaneous corrosion rate at any point in the core and to estimate the total corrosion at any point when the accident is over. 7 references. (auth)

19539 (DP-Report-789, pp 120-170) POWER REACTOR FUEL STUDIES. Mancini, G.; Shepherd, J.; Woloch, F. (Atomic Energy Establishment, Winfrith, Eng.). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

One of the functions of Dragon Project is to provide basic data and information necessary for HTR design. The project does not design nuclear power stations and in order to ensure that the research and development work on safety at Dragon was relevant, it was decided to set in hand a restricted programme of fault studies based on the Reference (or Notional) power reactor core specified by Mancini. The Reference Core is not meant to be the basis of an optimised fully engineered design but rather to form a focus for an examination in depth of generic safety problems. Consequently it is not necessarily representative of any particular commercial design. The programme of fault studies was therefore planned to reveal on a generic basis critical parameters, accuracies required in items of basic data and safety system requirements. 10 references. (auth)

19540 (DP-Report-789, pp 182-213) DEPRESSURISATION IN HTR WITH STEAM GENERATORS. Soubelet, G. C. (Atomic Energy Establishment, Winfrith, Eng.). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

The computer models DEPTRES and COLLOQ developed by the Dragon Project to study transients in HTR-steam power generating plant are described. A further Dragon computer programme CIPLAY is described, with which transient temperature profiles in the reactor core are calculated when transient gas inlet conditions are supplied from the results of the plant studies. Results are given for depressurisation accident transients with a number of pressure decay rates and with blowers and reactor tripped from either pressure level or pressure change rate signals. (auth)

19541 (DP-Report-789, pp 220-235) SAFETY PHILOSOPHY AND DESIGN PRINCIPLES. Beswick, T. C. (Central Electricity Generating Board, Cheltenham, Eng.). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

Contracts for the preliminary design and development of a single 660 MW(e) HTR station were given by the CEGB to the two UK nuclear power station Design and Construction Companies in November 1969. The Board issued a functional specification in January 1971 and in April this year station design submissions were made by both companies together with budget prices for construction of a station and firm prices for the additional design and development work required. A review of reactor systems (AGR, HTR, SGHW, BWR and PWR) is currently underway in the UK and a decision will not be made on whether or not to proceed with HTR until this review has been completed probably early next year. Requirements conveyed by the CEGB to the Design and Construction Companies by means of the station specification, reports and discussions are presented. (auth)

19542 (DP-Report-789, pp 237-263) SAFETY ASSESSMENT OF COMMERCIAL REACTORS. Fryer, D. R. H.; McCririck, H. (Department of Trade and Industry, London). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

The general safety philosophy applicable to reactors in concrete pressure vessels is described. In order to illustrate the position occupied by the HTR in the general spectrum of reactors available in the UK a comparison of the parameters bearing on reactor safety is discussed. The more sensitive areas of the HTR such as leaking fuel, helium coolant, high temperature, transient behaviour and boiler system are then outlined. The outstanding HTR safety problems are analyzed. (auth)

19543 (DP-Report-789, pp 323-353) ENGINEERED SAFETY IN A COMMERCIAL HIGH TEMPERATURE GAS COOLED REACTOR. Ward, D. A. (British Nuclear Design and Construction, Ltd., Whetstone). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

The main features and operating conditions of a High Temperature Reactor station are described. The fission product retention characteristics of the reactor are briefly discussed to illustrate that one aspect of the safeguards engineering lies in the restriction of fuel element temperature transients. A study of the behaviour of the reactor system under a variety of imposed fault conditions is summarised. This demonstrates how the characteristics of the system lead to the formulation of a number of safety principles and system constraints. These show that the major emphasis of the engineered safeguards is in the prevention of coolant temperature excursions and in the preservation of a low helium leakage from the primary containment. The essential systems designs are reviewed to show how the system constraints are met. A low helium leak rate and a very low gaseous activity discharge can be achieved by the combination of a pre-stressed concrete pressure vessel and a number of design provisions, which are described. A number of design options are available to effect further reduction of both the leakage and activity discharge. 6 references. (auth)

19544 (DP-Report-789, pp 354-360) SAFETY OF MARK III REACTORS. Bowen, J. H.; Farmer, F. R. (UKAEA, Risley, Eng.). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

The broad new factors introduced by the safety characteristics of the HTR into the engineering and operating requirements are discussed. (auth)

19545 (DP-Report-789, pp 371-403) GAS COOLED REACTOR PLANT SAFETY. Wessman, G. L. (Gulf General Atomic Co., San Diego, CA). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

The designs of High-Temperature Gas-Cooled Reactor plants that have been built and are being offered in the United States are

reviewed. The safety considerations involved in the design of the plants being offered are discussed. (auth)

19546 (DP-Report-789, pp 404-423) SAFETY DESIGN OF THE THRT 300 MW(e). Baust, E.; Gabriel, H. W. (Hochtemperatur-Reaktorbau GmbH, Mannheim, Ger.). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

The THTR 300 MW(e) nuclear power plant is the second construction project of the Thorium High Temperature Reactor line of HRB. It is being constructed by the consortium BBC Mannheim, HRB, and NUKEM Hanau on the order of the Hochtemperatur-kernkraftwerk GmbH Uentrop (HKG) on the site of the VEW power station Westfalen in Schmehausen. The construction period is estimated to last from 1971 to 1976. It has been confirmed by the precursors of this nuclear power plant, the 15 MW(e) AVR experimental nuclear plant in Juelich which reached first criticality in 1966, as well as by the experimental power plants DRAGON (20 MW(t)) and Peach Bottom (40 MW(e)) that nuclear power plants of this type can be operated at an extremely high safety level. High temperature helium technology in its present state can be applied to power generation and process heat generation. 11 references. (auth)

19547 (DP-Report-789, pp 434-444) SAFETY REQUIREMENTS FOR FRENCH REACTORS. Justin, F. (Commissariat a l'Energie Atomique, Saclay, France). Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

Legal requirements in order to assure the protection of the public against the risks from the nuclear reactors are described. Basic safety health standards are precisely defined, but could change if new knowledge justifies it. (auth)

19548 (DP-Report-789, pp 445-487) PRESENT STATE OF DATA IN THE SAFETY ANALYSIS OF THE HTR. Flowers, R. H. (Atomic Energy Research Establishment, Harwell, Eng.); Sayers, J. B.; Price, M. S. T. Apr 1972.

From proceedings on safety aspects of high temperature reactor systems; Paris, France (24 Nov 1971).

In safety aspects of high temperature reactor systems. (UKAEA Reactor Group, Winfrith. Atomic Energy Establishment).

The use of a large number of small coated fuel particles, and the unusual possibility of knowing fission product diffusion rates in the canning materials, has led to the expectation of a much more quantitative analysis of fission product release from the HTR core than from any previous reactor type. This analysis has shown that in normal operation there must be a minute but predictable release, and at first sight this may appear to be a retrograde step in fuel design. The customary situation is that an essentially zero fission product release may be interrupted by large unpredictable releases due to can failure and activation products from in-core parasitic metals provide a significant and irregular hazard. In the HTR unforeseen release of fission products may be classified "incredible" with a clear conscience and in which activated impurities will probably be at much lower level due to the absence of metals in the core. These advantages are however dependent upon a reliable set of data relating to particle failure and fission product transport. 75 references. (auth)

19549 (EPA-520/3-75-019) RADIONUCLIDE PRODUCTION, TRANSPORT, AND RELEASE FROM NORMAL OPERATION OF LIQUID-METAL-COOLED FAST BREEDER REACTORS. Erdman, C. A.; Kelly, J. L.; Kirbiyik, M.; Reynolds, A. B. (Virginia Univ., Charlottesville (USA). Dept. of Nuclear Engineering). Nov 1975. Contract 68-01-0547. 238p.

Sources of radioactivity from the normal operation of an LMFBR, and the transport of this radioactivity, were studied. Reliance was placed predominantly on published results although some new calculations were made where needed. Results were normalized to a 1000 MW(e) LMFBR and compared to values for a 1000 MW(e) LWR. Sources of radioactivity which were studied included plutonium and other transuranium elements, fission products, tritium, corrosion products, activation products, and tramp fuel. The study of the transport of radionuclides included reviews of transport of fission products and fuel from failed fuel, behavior of radioactivity in sodium and cold traps, and operation of gaseous radwaste systems. Operating experience for liquid metal cooled reactors relating to radioactivity was reviewed. Included were data from the fast reactors EBR-II, Fermi, SEFOR, Dounreay, Rapsodie, and BR-5, and limited data from the thermal reactors SRE, S8ER, and Hallam. (auth)

19550 (ERDA-1535(Vol.1)) FINAL ENVIRONMENTAL STATEMENT, LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume 1. (Energy Research and Development Administration, Washington, D. C. (USA)). Dec 1975. 493p. Dep. NTIS $12.50.

Information is presented under the following section headings: LMFBR program options and their compatibility with the major issues affecting commercial development, Proposed Final Environmental Statement for the LMFBR program, December 1974, WASH-1535, supplemental material, and material relating to Proposed Final Environmental Statement review. (DG)

19551 (ERDA-1535(Vol.2)) FINAL ENVIRONMENTAL STATEMENT, LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume 2. (Energy Research and Development Administration, Washington, D. C. (USA)). Dec 1975. 639p. Dep. NTIS $16.25.

Included are copies of fifty-six comment letters on the Proposed Final Environmental Statement together with the ERDA replies to these letters. The letters were received from Federal, State, and local agencies, environmental and public interest groups, members of the academic and industrial communities, and individual citizens. (DG)

19552 (ERDA-1535(Vol.3)) FINAL ENVIRONMENTAL STATEMENT, LIQUID METAL FAST BREEDER REACTOR PROGRAM. Volume 3. (Energy Research and Development Administration, Washington, D. C. (USA)). Dec 1975. 832p. Dep. NTIS $21.25.

Included are copies of thirty-four comment letters on the Proposed Final Environmental Statement together with the ERDA replies to these letters. The letters were received from Federal, State, and local agencies, environmental and public interest groups, members of the academic and industrial communities, and individual citizens. (DG)

19553 (FRNC-TH-539) EXPERIMENTAL AND THEORETICAL STUDY OF A PARTICULAR TYPE OF TRANSIENT FLOW OF BOILING SODIUM: FLOW EXCURSION. Study Carried Out in the Framework of the Fast Neutron Reactor Safety. Schmitt, F. (Grenoble-1 Univ., 38 (France)). 1974. vp. (In French). INIS.

The flow excursion phenomenon following pump failure without safety rod drop was studied in the framework of safety analyses for sodium cooled fast reactors. The experimental study, performed on an out-of-pile circuit with sodium forced convection, allowed the flow excursion due to boiling in a single heated channel in parallel with a by-pass to be investigated. The first phase is characterized by a relatively slow decay of the (mean) flow rate through the channel from its initial value (corresponding to starting boiling) up to a mean value near zero; its duration is of the order of ten or thirty seconds. The second phase appears when the boiling zone occupies an important fraction (half or three quarters) of the heated length of the channel. The mean flow rate has a low value, near zero; the flow rate is oscillatory (chugging) and is formed of vapor plugs parted by liquid bundles. This chugging phase lasts two or three seconds. The computation model developed described simply the boiling liquid flow (homogeneous sliding model) and the heat transfer between the heating medium and the fluid. The transient terms are neglected in continuity and energy equations so that the fluid in the channel is incompressible and its thermal inertia zero. (FR)

19554 (GA-A-13703) GCFR REACTOR SAFETY PROGRESS REPORT, JULY 1, 1974–JUNE 30, 1975. (General Atomic Co., San Diego, Calif. (USA)). 12 Dec 1975. Contract E(04-3)-167. 123p. Dep. NTIS $5.45.

A summary of the progress of work performed on a program of safety studies for the GCFR is presented. This work has been directed principally into three areas reported under three separate sections: the first section covers the probabilistic analysis of the accident sequences potentially initiating a loss of in-place coolable core geometry; the second section reports on efforts directed at qualitatively identifying key CDA phenomena; and the third section summarizes analytical efforts directed at characterizing one of these key CDA phenomena, namely the potential for fuel element duct walls melting prior to fuel melting in a shutdown reactor and thus precluding recriticality. (auth)

19555 (LA-6161-PR) HTGR SAFETY RESEARCH PROGRAM PROGRESS REPORT, JULY–SEPTEMBER 1975. Kirk, W. L. (comp.). (Los Alamos Scientific Lab., N. Mex. (USA)). 1975. Contract W-7405-Eng-36. 49p. Dep. NTIS $5.50.

Information on HTGR safety research is presented concerning fission product release under normal and accident conditions, primary coolant impurities, structural investigation, safety instrumentation and control systems, reactor accident analysis, and phenomena modeling and systems analysis. 72 references. (DCC)

19556 (NCSR-R-4) RELIABILITY OF PNEUMATIC CONTROL EQUIPMENT: A CASE STUDY IN MECHANICAL RELIABILITY. Moss, T. R. (UKAEA National Centre of Systems Reliability, Culcheth). Aug 1975. 27p. Dep. NTIS (US Sales Only) $4.00.

A reliability assessment of automatic feedwater control systems to be installed in a nuclear power station indicated relatively high rates of failure from the pneumatic control equipment. The predictions were, however, at variance with the early operating experience of identical prototype systems installed elsewhere, and doubts were cast on the validity of the simple exponential model of failure employed in the assessment. These doubts have been largely substantiated. This study indicates that the level of faults potentially hazardous to the reactors is likely to be about a factor of 10 lower than predicted. It is shown that the failures of equipment employed in the systems are initially distributed according to Weibull functions. A constant rate of failure (i.e., simple exponential distribution) will emerge at some stage but it will be dependent on the randomizing effects of repeated maintenance rather than the chance combination of stress factors normally associated with failures in the useful-life phase. The majority of mechanical systems in industrial situations are also expected to follow Weibull distributions. The factors which cause this appear to be largely determined by the system's normal loading characteristics. An evaluation of the load function and its effect on individual component lifetime is therefore essential if mechanical equipment failure rates are to be predicted theoretically. (auth)

19557 (NCSR-R-5) COMPUTER DETERMINATION OF EVENT MAPS WITH APPLICATION TO AUXILIARY SUPPLY SYSTEMS. Wredenberg, L.; Billinton, R. (UKAEA National Centre of Systems Reliability, Culcheth). 1975. 10p. Dep. NTIS (US Sales Only) $3.50.

A method of evaluating the reliability of sequential operations in systems containing standby and alternate supply facilities is presented. The method is based upon the use of a digital computer for automatic development of event maps. The technique is illustrated by application to a nuclear power plant auxiliary supply system. (auth)

19558 (ORNL-5046, pp 14-52) REACTOR STUDIES. Barnes, P. R.; Chester, R. O.; Davis, R. R.; Chester, C. V.; Cristy, G. A.; Manweiler, R. W. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

As part of the national Nuclear Energy Center site survey, the effects of national security considerations, of terrorist or sabotage threat, and of natural disasters on the NEC are being studied. Work has been started on the methods and costs of recovery from major accidents under the NEC siting concept. (auth)

19559 (ORNL-MIT-62) INVESTIGATION OF THE CONSEQUENCES OF A NUCLEAR REACTOR CORE MELT-THROUGH ACCIDENT. Reimer, R. A.; Seidenfeld, A. (Oak Ridge National Lab., Tenn. (USA)). 18 Oct 1968. 42p. Dep. NTIS $4.00.

A core melt-through was assumed to occur in a 3200-Mw(t), water-cooled reactor, and the interactions of the molten fuel material were examined after it had entered the primary containment vessel. It was shown that large quantities of carbon dioxide would be emitted if the core material were allowed to come in contact with limestone aggregate concrete, and that other gases might be emitted if temperatures were high enough. It was also shown that the rate of fission product decay heat production by the core of a 3200 MW(t) reactor would be too great to allow heat removal by any internal mechanism depending finally on conduction through the walls of the primary containment vessel. Several methods of containing the molten core and dissipating the heat were evaluated and some feasible solutions to the problem were presented. (auth)

19560 (ORNL-TM-5076) LMFBR SAFETY AND CORE SYSTEMS PROGRAMS PROGRESS REPORT FOR APRIL-JUNE 1975. Fontana, M. H.; Wantland, J. L. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 146p. AT.

Progress is summarized in the areas of fluid flow analysis and data evaluation, boiling detection methods development, Fuel Failure Mockup Facility operation, and heater development. (DG)

19561 (ORNL-TM-5145) EVALUATION OF THE STRUCTURAL INTEGRITY OF LMFBR EQUIPMENT CELL LINERS: RESULTS OF PRELIMINARY INVESTIGATIONS. McAfee, W. J.; Sartory, W. K. (Oak Ridge National Lab., Tenn. (USA)). Jan 1976. Contract W-7405-eng-26. 204p. Dep. NTIS $8.75.

The behavior of a plane wall segment of a prototype liquid-metal-cooled fast breeder reactor (LMFBR) cell under conditions of a postulated massive sodium spill was studied. Sodium-concrete reaction calculations were performed assuming an initial flaw existed in the liner such that high-temperature sodium could penetrate to the concrete underneath. Based on existing sodium-concrete reaction rate data, bounding values were established for the maximum energy release per unit volume of concrete. The potential effect of this energy release on the deformation of the liner material was determined. The temperature buildup in the liner and the pressure differential across the flaw in the liner were also studied. The transient thermal and structural responses of the steel liner and backup concrete were analyzed in detail using the inelastic computer code ANSYS. The literature on the mechanical, physical, and general behavior properties of concrete at high temperature was reviewed. This review emphasized the structural behavior of concrete and did not cover the sodium-concrete reaction. (auth)

19562 (XN-75-36NP) SPRAY COOLING HEAT TRANSFER PHASE I TEST RESULTS ENC: 8 x 8 BWR FUEL, 60 AND 63 ACTIVE RODS. Interim Report. Gaines, S. F.; Leach, C. E.; Barkhurst, D. J. (Exxon Nuclear Co., Richland, Wash. (USA)). 13 Oct 1975. 65p. Exxon Nuclear Co. Inc., Richland, WA.

The first-phase test results of a contemplated two-phase test program are reported. The purpose of the test program is to confirm the spray cooling heat transfer performance of the Exxon Nuclear Company (ENC) 8 x 8 BWR fuel design under conservatively represented loss-of-coolant-accident (LOCA) conditions. The test fuel assembly is a geometric mock-up of the 8 x 8 design with 63 potentially active rods, of which three rods located toward the center can be deactivated to simulate the ENC 8 x 8 design with four centrally located inert rods. The channel and adjacent hardware provide a mockup of the fuel assembly channel/control rod configuration. However, since the thermal boundary conditions as may exist in the reactor during a LOCA are not exactly simulated, the fuel assembly temperature achieved in these tests is not intended to be representative of the expected fuel assembly temperature during a LOCA. The heat transfer coefficients and inert rod wetting front data derived from the tests should be representative of reactor coefficients and wetting because the difference in boundary conditions is taken into account in the models. Wherever possible, conditions expected to exist in the hot assembly during spray cooling have been simulated in the tests. The test results confirm the conservative character of the heat transfer coefficients used in the HUXY analysis of 8 x 8 fuel (auth)

19563 (XN-75-36NP(Suppl.1)) SPRAY COOLING HEAT TRANSFER PHASE I TEST RESULTS ENC: 8 x 8 BWR FUEL, 60 AND 63 ACTIVE RODS. Interim Report, Supplement I. Gaines, S. F.; Leach, C. E.; Barkhurst, D. J. (Exxon Nuclear Co., Richland, Wash. (USA)). 15 Oct 1975. 27p. Exxon Nuclear Co., Inc., Richland, WA.

Presented in this supplement are results of additional analysis performed on data obtained from the Phase I ENC 8 x 8 Fuel Cooling Test Program. This supplement contains analysis on the steady-state tests, which confirm the use of an average emissivity for stainless steel in the data reduction. Studies are also included on the sensitivity of the PCT and convective coefficients to emissivity. These studies confirm the use of an average emissivity. Correlation of experimentally determined convective coefficients with surface temperature is also reported. (auth)

19564 NUCLEAR ENERGY AND SOCIAL COSTS. Ellens, S. H. (Bureau Ellens, The Hague). Econ. Stat. Ber.; 60: No. 3010, 693-695(16 Jul 1975). (In Dutch)

The author introduces a new concept under the name "social costs," defining it more or less as that which society is prepared to pay to solve the risks taken when a new technological system is introduced into that society. Social costs are the result of a complex of advantages and disadvantages inherent to a system. Applying this principle, a comparison is given of the health hazards involved in power generation by nuclear power plants and plants working on natural gas, oil or coal. (NL)

19565 HYDRODYNAMIC CONTAINMENT FOR UNDERGROUND NUCLEAR POWER PLANTS. Cardito, J. M.; Somers, E. V.; McWhirter, J. H. (Westinghouse Research Labs., Pittsburgh). Nucl. Technol.; 28: No. 1, 119-126(Jan 1976).

The containment capability of mined subterranean caverns for siting nuclear power plants depends on the flow of groundwater through porous media surrounding the cavern. For a simple cylindrical containment cavern, design correlations were developed relating depth of burial to cavern overpressure. Considering 50 psig as the maximum containment overpressure following a postulated loss-of-coolant accident (LOCA), the minimum depth of burial below the groundwater table for a cavern of 50-ft radius is approximately 200 ft. These conditions assure no cavern water flow through the rock to the atmosphere and no cavern contaminant seepage into the groundwater following a postulated LOCA. (auth)

19566 SAFETY RESEARCH ON NUCLEAR FACILITIES IN JAPAN. Mukaibo, T. (Univ. of Tokyo, Tokyo). pp Paper 4.2-1, 22p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910–P4.

A description is given of nuclear plant safety research, research on radioactive and environmental pollution, and research on the effects of thermal effluents and their countermeasures. (auth)

19567 ENVIRONMENTAL ASPECTS OF THE SPANISH NUCLEAR POWER PROGRAM. Perez, B. L.; Iranzo, E.; Trueba, P. (Junta de Energia Nuclear, Madrid). pp Paper 4.2-16, 24p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910–P4.

19568 NUCLEAR POWER STATIONS OF VERY HIGH CAPACITY OF TOMORROW AND THEIR CONSTRAINT ON THE ENVIRONMENT: STUDY OF A SOLUTION. Widmer, M.; Mascarello, J. M.; Ventre, E.; Robert, J. M. pp Paper 4.2-21, 21p. of 9th World Energy Conference. London; World Energy Conference (1974). (In French)

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910–P4.

Unit power of energy producing power stations is expected to increase further in the future. The problem of the cooling source thus becomes of prime importance and is bound to influence design of the power station, its thermodynamic cycle and its generating machines. The stated solution of this problem consists in using a binary water/ammonia cycle with direct ammonia condensing by means of a dry, atmospheric cooling tower. The feasibility of such a solution is shown. It resolves thermic pollution and high output problems. Furthermore, it largely increases freedom as far as the choice of the site is concerned: decreases transportation costs, reduces possibility of sites in uninhabitable regions, etc.... The study also deals with economic aspects and concludes, as far as France is concerned and for a medium term nuclear future, that such a choice may lead to a good solution thanks to the free choice of site rendered possible. (auth)

19569 ELECTRIC POWER AND THE CIVIL ENGINEER. Conference Held at Boulder, Colorado, August 12–14, 1974. New York; American Society of Civil Engineers (1974). 676p. (CONF-740829-). $10.00.

From ASCE power division specialty conference; Boulder, Colorado, USA (13 Aug 1974).

Twenty-eight papers were presented at the conference. A separate abstract was prepared for two papers for NSA. One of these papers was also abstracted for ERA. Nineteen papers were included in the ERDA energy data base. (RCK)

For abstracts of individual papers see: 19570 and 19571.

19570 SEISMIC ANALYSIS AND DESIGN OF THE SAN ONOFRE NUCLEAR GENERATING STATION, UNITS 2 AND 3 CONTAINMENT. Wiley, J. W. (Bechtel Power Corp., Norwalk, CA); Schechter, K. M.; Price, D. L.; Koss, P. W. pp 13-40 of Electric Power and the Civil Engineer. New York; American Society of Civil Engineers (1974).

From ASCE power division specialty conference; Boulder, Colorado, USA (13 Aug 1974). See CONF-740829-.

Because the San Onofre Nuclear Generating Station, Units 2 and 3, is located in a seismically active western region, design and analysis of the plant had to consider the seismic loads applied to the various safety-related structures, components, and equipment as loads that could control the overall layout and design of the power block. An attempt was made to find an optimum design that would minimize cost penalties associated with these loads, but still provide a high seismic resistant structure. Design and analysis of the containment and interior structure are discussed. Evolution of the containment layout is traced and the analysis procedures for developing in-structure response spectra and the results and the effects of significant parameters are also discussed. (auth)

19571 SOIL STRUCTURE INTERACTION PROBLEMS FOR NUCLEAR CONTAINMENT STRUCTURES. Kausel, E.; Roesset, J. M. pp 469-498 of Electric Power and the Civil Engineer. New York; American Society of Civil Engineers (1974).

From ASCE power division specialty conference; Boulder, Colorado, USA (13 Aug 1974). See CONF-740829-.

The problems of soil amplification and soil structure interaction have been the subject of considerable research in recent years, particularly in relation to the seismic design of nuclear power plants. A number of sophisticated mathematical techniques and simpler engineering approximations have been developed to estimate their effects on structural forces, and more importantly, on the characteristics of the motion at different floor levels (amplified response spectra for the design of equipment). There is however some confusion and controversy on the mathematical accuracy of some of these methods and the physical significance of others. Sometimes elaborate techniques are judged appropriate even when based on incorrect assumptions, and often methods which can be shown to be mathematically equivalent are classified as different because of inconsistencies in their implementation. The various methods of analysis now available and their similarities and differences when based on consistent assumptions are examined. (auth)

19572 RATIONALE OF REACTOR SITE SELECTION FOR PUBLIC SAFETY. Beattie, J. R. (United Kingdom Atomic Energy Authority Safety and Reliability Directorate, Warrington, Eng.). Nucl. Technol.; 27: No. 2, 233-239(Oct 1975).

Using an assumption that the safety of the reactor can be made to conform to a release frequency limit line proposed in 1967 by F. R. Farmer, the highest risk to an individual member of the population is calculated, and it is suggested that this will be negligible compared to the risks of everyday life, and negligible compared to the collective risk to the population from reactor accident releases. These collective risks are assessed and analyzed, with two aspects—the risk of deaths occurring from radiation-induced cancer and the risk of loss of productive capacity by the community as a result of radioactive contamination of property—being selected as the most important risks to study. 25 references. (auth)

19573 FLOW OF RADIOACTIVE FLUID THROUGH THE SOIL SURROUNDING A POWER-REACTOR STATION AFTER A CORE MELTDOWN ACCIDENT. Pitts, J. H. (Univ. of California, Livermore). Nucl. Technol.; 27: No. 2, 240-247(Oct 1975).

Ideal gas and multiphase flow through porous soil surrounding a nuclear power generating station after a core meltdown accident are analyzed with dimensionless variables. Results are applicable to many soil conditions. The extent of radioactive fluid penetration into the soil, predicted using methods originally developed by Morrison, indicates that years are required for activity to reach the ground surface if silty clays are present but only approximately 10 h if a path of sand is included. Source pressure decay caused by mass flow into the soil is small if the normal conditions of a large containment shell volume and low soil permeability exist. 7 references. (auth)

19574 USE OF THE "LAGRANGIAN AND EULERIAN POINTS OF VIEW" IN THE TRANSIENT CRITICAL HEAT FLUX CALCULATIONS FOR BWR ROD BUNDLES AND EXPERIMENTAL VERIFICATIONS. Marinelli, V. (CNEN, Rome); Pellei, A.; Vallero, P.; Vitanza, C. Nucl. Technol.; 27: No. 2, 207-215(Oct 1975).

The calculations performed in comparison of the "Lagrangian point of view", by means of the DOLCE computer code with the local space–time approach of the "Eulerian point of view" indicate that the two methods give substantially equivalent results and predict satisfactorily the onset of the transient CHF for the Centro Informazioni Studi Esperienze annuli experimental data and General Electric Company 16-rod bundles data under typical boiling water reactor transients, including loss-of-coolant accident simulations. 9 references. (auth)

19575 POWER PLANT SITING: A PARETIAN ENVIRONMENTAL APPROACH. Gros, J. (International Institute for Applied Systems Analysis, A-2361 Laxenburg, Austria). Nucl. Eng. Des.; 34: No. 2, 281-292(Nov 1975).

Several different interest groups are involved in the siting decision process for nuclear power plants. Their inputs and how the final decision affects them are usually not explicitly included in mathematical analyses. Paretian analysis is a technique which attempts to identify the preferences of each of the interest groups involved in the decision-making process, and to illuminate the trade-offs among these groups. The specific problem studied is the deployment by a regional power plant siting agency of nuclear base-load power plants to coastal sites in New England. Four interest groups participate in power plant siting decisions; utility functions can represent their preferences. Techniques to find Pareto-admissible decisions are described. (NL)

19576 THEORETICAL MODEL WITH VARIABLE MASSES FOR THE MOLTEN FUEL-SODIUM THERMAL INTERACTION IN A NUCLEAR FAST REACTOR. Caldarola, L. (Kernforschungszentrum Karlsruhe (F. R. Germany). Inst. fuer Reaktorentwicklung). Nucl. Eng. Des.; 34: No. 2, 181-201(Nov 1975).

The reaction has been assumed to occur in two successive

phases, A and B. Phase A. A given number (function of time) of fuel particles come into intimate contact with a given mass of liquid sodium (function of time). The heated volume of sodium is constrained by the surrounding unheated coolant and by the other materials present in the core. The sudden expansion of the heated volume first produces acoustic waves which travel along the sodium column. Later the sodium column behaves like a piston which is pushed inertially upwards. The pressure rises, reaches a maximum, and then falls as soon as the expansion of the liquid sodium becomes important. Phase B. The sodium will boil in a large quantity, and will therefore produce large volume changes. The sodium piston will be further accelerated and its movement will allow the pressure in the reaction volume to decrease. The model accounts for the time history of the temperatures of each fuel particle by means of the use of specially averaged temperature values. The calculation of the heat transfer coefficient during phase B is based on experimental results. It has been concluded that the total work produced decreases with the time scale of the particles and increases with the speed at which the fuel breaks down into fragments and mixes with the liquid sodium. (NL)

19577 AEROSOL INVESTIGATION BY RCN. II. Investigation of Aerosols in Connection With Nuclear Reactors. Van de Vate, J. F.; Plomp, A.; de Jong, C. Atoomenerg. Haar Toepass.; 17: No. 11, 240-246(Nov 1975). (In Dutch)

The stability of radioactive substances formed during a hypothetical serious accident inside the safety container of a fast sodium-cooled reactor was investigated, assuming that the aerosol contains sodium. A table lists data for the atmospheric stability of vapor/gas systems. Data obtained from various experiments are discussed. (NL)

19578 REVIEW OF THE I. A. E. A. SYMPOSIUM ON THE SITING OF NUCLEAR FACILITIES. Shaw, J. (Queen Mary Coll., London). Ann. Nucl. Energy; 2: No. 7/8, 579-587(Aug 1975).

A symposium on the Siting of Nuclear Facilities organized by the International Atomic Energy Agency (IAEA) was held at the Headquarters of the Agency in Vienna, Austria from 9th to 13th December 1974. The conference was attended by some 230 delegates from 38 countries. Thirty-seven papers were presented, these being divided into four sessions under the general headings of: siting and national criteria and practices; siting and the environment; siting and reprocessing plants; new approaches to a siting policy and special problems. The symposium is summarized and reviewed from a personal viewpoint. The scope of the review does not enable detailed reference to be made to every paper. (auth)

19579 ANALYSIS OF A PWR VESSEL RUPTURE USING COMPUTER PROGRAMS RELAP-3 AND RELAP-4. Hughes, G. A.; Loyalka, S. K.; Meyer, W. (Univ. of Missouri, Columbia). Ann. Nucl. Energy; 2: No. 7/8, 545-553(Aug 1975).

A sensitivity study of a vessel rupture for the Indian Point-2 reactor was carried out using the computer programs RELAP-3 and WHAM. (Doan et al. Nuclear Safety, 14 (1961)). Since RELAP-3 has been superseded by the computer program RELAP-4, and since several anomalous results were observed with RELAP-3, the present study has been devoted to an analysis of the consequences of a vessel rupture with the computer program RELAP-4. Specifically, an attempt has been made to determine if RELAP-4 provides results that are more conservative (safer) than those reported by Doan et al. and if the anomalies obtained by the use of RELAP-3 are adequately removed. The present study has been based on a fourteen volume, sixteen junction system representing the Indian Point-2 reactor. Several hypothetical accident situations including bottom breaks, side breaks, top breaks of different sizes in the pressure vessel have been studied. Both the RELAP-3 and the RELAP-4 programs have been used to evaluate the same accident situations and a comparison of the results is presented. Detailed sensitivity studies have been carried out by using different values of gap thermal conductivity, break opening times, break sizes, location of breaks, cavitation coefficients, etc. Since RELAP-4 permits the use of several different finite differencing schemes and compressible or incompressible flow options, the effects of the use of these options on the results has also been examined. Based on the present results, it is concluded that generally RELAP-4 gives more conservative results than those obtained with RELAP-3 and that several of the anomalies observed with the use of RELAP-3 are effectively removed. (auth)

19580 POWERFUL ORGANIZATION WITH SAVINGS FOR YOU AS THE END PRODUCT. Beatson, C. Engineer; 241: No. 6238, 40-41(9 Oct 1975)

The experience in assessment of systems reliability gained by the UKAEA in more than 20 years research on the safety of nuclear reactors has for several years been made available to industry by the Systems Reliability Service, Culcheth, Warrington, England. This is operated by the UKAEA and has resulted in the formation of a National Center of Systems Reliability which incorporates the Systems Reliability Service extending and complementing its activities. An integral part of the facilities offered, is the Reliability Data Bank for collecting, storing, analyzing and disseminating data acquired from component, equipment, and installations in a wide range of industries. From this work, information on the failure modes of various components can be used to give quantitative forecasts of the reliability and availability to be expected from a specific plant. One such application was the reliability evaluation of the emergency engine-generator system of Fort St. Vrain. Other typical problem areas are discussed. (UK)

19581 NUCLEAR REACTOR SAFETY: THE APS SUBMITS ITS REPORT. (Univ. of California, Santa Barbara). Phys. Today; 28: No. 7, 38-43(Jul 1975).

The summary section of the report by the Study Group on Light-Water Reactor Safety is presented. The American Physical Society group confined itself to the technical issues of the safety of reactors typical of commercial practice in the U. S. A greatly expanded and redirected program in reactor safety research is recommended to reduce the uncertainties identified by the study group. (HDR)

Reactor Theory and Calculation

Refer also to abstract 19482.

19582 (CONF-740341-P2, pp vp Paper 9) FUNDAMENTALS OF NUCLEAR REACTOR PHYSICS. Ferber, R. R. 1974.

From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).

In 1974 electric utility engineering conference. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).

Background material concerning the physics of nuclear fission is reviewed. The controlled chain reaction process in a nuclear reactor is described. An analogy between chemical and nuclear reactors is used for illustrative purposes. (JWR)

19583 FISSION REACTORS. Symonds, J. L. (Flinders Univ. of South Australia, Bedford Park). pp 33-71 of Physics and the Energy Industry. Summer School in Physics. Bedford Park, South Australia; Flinders University (1974).

From summer school on physics and the energy industry; Bedford Park, Australia (Jan 1974). See CONF-740137-.

Basic concepts and definitions of the atomic nucleus, binding energy, forces between nucleons, neutron reactions, radioactive decay and nuclear fission are discussed. Fission reactor technology and the utilization of fission energy as a resource are also discussed. The problem of the environment and reactor safety are considered. (AT)

19584 SOLVING OF ELLIPTIC EQUATIONS WITH PARTIAL DERIVATIVES FOR FAST NUCLEAR REACTORS. Pavelescu, M.; Radulescu, D. (Inst. for Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 6, 593-596(1975).

From symposium on calculation methods and codes for fast reactors; Dimitrovgrad, Bulgaria (1974).

The solutions for the multigroup diffusion equations are presented for cylindrical finite reactors with axial symmetry by the over-relaxation method. The general lines of this work are outlined. Finally, the results obtained with a program STL 6 for IBM-370/135 are commented upon for test cases. (auth)

19585 ZERO POWER THERMAL REACTOR OPTIMIZATION BY THE GAME THEORY. Pavelescu, M.; Dumitrescu, H.; Ghilea, S. (Inst. for Atomic Physics, Bucharest). Rev. Roum. Phys.; 20: No. 6, 637-640(1975).

A zero power thermal reactor, heavy water moderated and natural uranium vitroceramic honeycomb fuel is considered. The minimum critical radius (R) and mass (M) are realized for different couples (p, r) (p-lattice pitch, r-fuel element radius). Because the variation of these parameters is generally opposite the problem has a bimatrix game structure. The reactor for which, at the same time, one minimizes R and M as much as possible is determined. (auth)

19586 SEPARATION OF DECAY CONSTANTS IN PULSED NEUTRON EXPERIMENTS ON A SUBCRITICAL ASSEMBLY USING SPACE MODAL ANALYSIS. Isbasescu, M.; Gheorghiu, E. (Inst. for Nuclear Tech., Bucharest). Rev. Roum. Phys.; 20: No. 6, 611-624(1975).

In the light water-natural uranium subcritical assembly HELEN of the Nuclear Training Center in Bucharest, the poor natural

separation of space modes due to deep subcriticality and eccentric source position imposed the use of space modal analysis. The formulas for parameter estimation are compared with those resulting from the consistent application of the maximum likelihood principle. Results are presented for the decay constants of five modes. (auth)

19587 TRANSFER MATRIX TREATMENTS FOR MULTIGROUP MONTE CARLO CALCULATIONS: THE ELIMINATION OF RAY EFFECTS. Carter, L. L.; Forest, C. A. (Los Alamos Scientific Lab., NM). Nucl. Sci. Eng.; 59: No. 1, 27-45(Jan 1976).

The coefficients of a truncated Legendre series are usually used in multigroup cross-section sets to describe the angular distribution for a group-to-group scattering event. Discrete ordinates codes use the truncated Legendre series because this representation of the scattering angle can be used with the addition theorem to conveniently treat the scattering source term. However, the truncated Legendre series has inherent disadvantages for Monte Carlo calculations. Discussions are presented of the truncated Legendre series representation, a discrete angle representation, a step function representation, and an exact representation that is applicable for isotropic scattering in the center-of-mass system. The three approximate representations use the coefficients of a truncated Legendre series as a working base. A sample problem shows that the step function representation has advantages for multigroup Monte Carlo calculations, and its inclusion as an option in multigroup codes is recommended. (auth)

19588 NEUTRON TRANSPORT WITH TEMPERATURE FEEDBACK. Belleni-Morante, A. (Istituto di Matematica Applicata, Firenze, Italy). Nucl. Sci. Eng.; 59: No. 1, 56-58(Jan 1976).

A nonlinear neutron transport problem is considered in a finite homogeneous body with temperature feedback. By using some techniques of the theory of evolution equations, existence and uniqueness of a mild solution u(t) are proven and an upper bound for parallel u(t) parallel is calculated. (auth)

19589 MULTIGROUP REPRESENTATIONS OF SLOWING-DOWN KERNELS IN H_2O. Edlund, M. C. (Virginia Polytechnic Inst., Blacksburg, VA); Jones, R. B.; Zweifel, P. F. Nucl. Sci. Eng.; 59: No. 1, 58-60(Jan 1976).

Nonleakage probabilities calculated in multigroup transport and diffusion theory are compared with experimental data. The results are used as a criterion for choosing energy group structures as well as the actual number of groups. In addition, the importance of using the correct type of computer code for generating groups constants is shown. (auth)

19590 GENERALIZED PERTURBATION METHODS IN TIME-DEPENDENT PROBLEMS. Gandini, A. (Comitato Nazionale per l'Energia Nuclear). Nucl. Sci. Eng.; 59: No. 1, 60-63(Jan 1976).

Generalized perturbation methods relevant to quantities linear with the neutron flux in time-dependent problems are discussed. In addition, it is shown how the well-known generalized perturbation formulations relevant to the static case under critical conditions can be simply derived. The time-dependent formulations in the neutron field may as well be applied to that of the nuclides in burnup and buildup problems by considering the buildup and decay matrix in place of the Boltzmann operator. (auth)

19591 FINITE ELEMENT SYNTHESIS METHOD. Yang, S. T.; Henry, A. F. (Massachusetts Inst. of Tech., Cambridge, MA). Nucl. Sci. Eng.; 59: No. 1, 63-67(Jan 1976).

A method for obtaining an approximate solution of the group-diffusion equations for geometrically complex reactors is described and tested for a two-group two-dimensional situation. The basic idea of the scheme is to represent the group fluxes throughout a given subassembly as the product of a precomputed normalized "shape function" that accounts for local geometrical detail and a smooth finite element function that specifies the overall magnitude of the fluxes within the subassembly and the gross leakage effects between a given subassembly and its neighbors. These composite fluxes for each subassembly are then stitched together by the application of a variational principle. (auth)

Reactor Components and Accessories

Refer also to abstracts 17134, 17150, 17222, and 17224.

19592 (PB-239366) SPHERICAL AND CYLINDRICAL HULLS OF REINFORCED CONCRETE. Osgood, E. C. (Massachusetts Univ., Amherst (USA)). Aug 1973. 24p. (NSF/RANN/SE/GI-34979/TR/73/14). NTIS $3.25.

See also PB-239367.

The feasibility and practicality of using reinforced concrete are investigated for the construction of spherical and cylindrical hulls to enclose submerged atomic power plants. The stresses of a spherical shell, which is submerged in water and loaded for neutral buoyancy, are analyzed. Membrane stress theory is applied to determine the stresses for the three types of loads (water pressure, weight of shell, and internal or imposed load) and type of shell assumed. Mathematical expressions are derived for the membrane stresses for both the upper and lower hemispheres of the sphere. Finally, using the working stress method, the safe strength of reinforced concrete is calculated to be 1103 k/ft. Because the safe strength is greater than the maximum stress, it is much more than adequate everywhere. One approach to construction, which involves fabricating a cage made up of trusses formed by the reinforcing steel, is illustrated. (GRA)

19593 (PB-239367) STRESS ANALYSIS OF A CYLINDRICAL SHELL (AXIS HORIZONTAL) SUBMERGED IN WATER AND LOADED FOR NEUTRAL BUOYANCY. Osgood, E. C. (Massachusetts Univ., Amherst (USA)). Sep 1973. 28p. (NSF/RANN/SE/GI-34979/TR-73/16). NTIS $3.75.

The stresses of a cylindrical shell (axis horizontal), which is submerged in water and loaded for neutral buoyancy, are analyzed. Statically indeterminate stress theory is applied to determine the stresses for the three types of loads (water pressure, weight of shell, and internal or imposed load). Design equations are derived for bending moments, axial stresses, shears, and reactions of the loads. Then probable dimensions are chosen and numerical values for the stresses are computed. Various conclusions are reached: (1) reinforced concrete shells of the proposed diameters and submergence are structurally practical, if the proper shapes are chosen; (2) the sphere is a particularly practical shape; (3) due to very high bending stresses found from ring analysis of cylinders, dependence on stress resistance, in the ring direction only, is impractical for these shells; and (4) the best way to obtain neutral buoyancy of a submerged shell is to decrease the free space allowed for equipment and operation. (GRA)

19594 APPLICATION OF SODIUM HYDROGEN PHOSPHATE TO THE ONCE-THROUGH STEAM GENERATOR OF AN ENGLISH NUCLEAR POWER STATION. Parry, D. J.; Tasker, P. W.; Tyldesley, J. D. VGB Kraftwerkstech.; 55: No. 2, 105-109 (Feb 1975). (In German)

The ideal feed water and the adjustment of the pH and O content to reduce corrosion are discussed. Pretreatment of the water with Na_2HPO_4 is the most suitable method, and tests in which $^{24}Na_2HPO_4$ was used while $MgCl_2$ was also added showed that the accumulation of chloride in the feedwater could be kept down to a safe level. (Metals Abstr.)

19595 ELECTRIC BOILER: INDISPENSABLE ACCESSORY OF NUCLEAR POWER PLANTS. Stucheli, A. (Societe SULZER-FRERES, Winterthur, Switzerland); Chevailler, C. Entropie; 11: No. 63, 28-35(1975). (In French).

In the 1980s industry in general will have to use existing energy sources both rationally and ecologically. The Utilities and National Electricity Boards, who at that time, will have most surely concentrated the majority of their investments in nuclear power plants, will be in a position to supply private industry with this modern clean form of energy, at a reasonable price. To transform this electrical energy to heat energy in the most economical manner, water heating or steam producing plant with an efficiency of almost 100%, will be required. This equipment has in fact existed since the turn of the century, it is the electric boiler. (auth)

19596 SEALS FOR SEALING A PRESSURE VESSEL SUCH AS A NUCLEAR REACTOR VESSEL OR THE LIKE. Bruns, H. J.; Huelsermann, K. H. (to Deutsche Babcock and Wilcox Aktiengesellschaft). US Patent 3,915,462. 28 Oct 1975. Priority date 14 Sep 1973, German, Federal Republic of (F. R. Germany). 10p.

A description is given of seals for sealing a pressure vessel such as a nuclear reactor vessel, steam boiler vessel, or any other vessel which is desirably sealed against pressure of the type including a housing and a housing closure that present opposed vertical sealing surfaces which define the sides of a channel. The seals of the present invention comprise at least one sealing member disposed in the channel, having at least one stop face, a base portion and two shank portions extending from the base portion to form a groove-like recess. The shank portions are provided with sealing surfaces arranged to mate with the opposed vertical pressure vessel sealing surfaces. A shank-spreading wedge element also disposed in the channel has at least one stop face and is engaged in the groove-like recess with the sealing member and wedge element stop face adjacent to each other. (Official Gazette)

19597 METHOD AND APPARATUS FOR TESTING CLOSED-END TUBES IN HEAT EXCHANGERS OF NUCLEAR REACTORS AND THE LIKE. Seyd, G.; Bergbauer, A.; Paulsen, U. (to

Siemens Aktiengesellschaft). US Patent 3,919,880. 18 Nov 1975. Priority date 9 Jun 1971, German, Federal Republic of (F. R. Germany). 6p.

A description is given of a test stopper which is insertable into a tube closed at one end for testing the tightness of the tube with a fluid under pressure, the tube being in a heat exchanger of a nuclear reactor or the like. The test stopper includes a tubular outer jacket that is expandable outwardly to tightly seat the stopper in the tube. The stopper also has front and back end-face members joined to the ends of the outer jacket to define a closed space within the jacket. With the stopper inserted into the tube, the front end-face member and the closed end portion of the tube define a closed inner region of the tube. An inner tubular member, disposed within the outer jacket, partitions the closed space within the jacket into an annular outer chamber and a cylindrical inner chamber. A pressure-fluid supply selectively supplies fluid to the chambers. The outer jacket expands in response to fluid admitted to the annular chamber and the front end-face member has a through bore to admit fluid under pressure to the inner region of the tube. A method of testing of such a tube with a fluid under pressure includes inserting the test stopper into the tube and then expanding the outer jacket of the stopper to seat the stopper firmly in the tube. A fluid under pressure is directed through the stopper and into the closed region defined by the front end-face member of the stopper and the closed end portion of the tube. The pressure of the fluid introduced into this closed region is monitored for detecting a leak in the closed-end tube. (Official Gazette)

19598 CENTRIFUGAL PUMP ASSEMBLY FOR USE IN NUCLEAR REACTOR PLANTS OR THE LIKE. Honold, E.; Ruepp, M. (to Klein, Schanzlin-Becker Aktiengesellschaft). US Patent 3,918,272. 11 Nov 1975. Priority date 16 Dec 1972, German, Federal Republic of (F. R. Germany). 6p.

A description is given of a vertical centrifugal pump assembly for use as a primary recirculating pump in a nuclear reactor plant which has an uppermost shaft which is driven by a motor, a lowermost shaft which drives the impeller of the pump, and an intermediate shaft which is movable axially between the uppermost and lowermost shafts and carries a housing for radial and/or thrust bearings. A rigid coupling between the lowermost shaft and the intermediate shaft is disengaged when the intermediate shaft is lifted to thereby afford access to certain parts of the lowermost shaft. The uppermost shaft can drive the intermediate shaft through the medium of a flexible coupling having coupling elements mounted on the lower end of the uppermost shaft and the upper end of the intermediate shaft, and a distancing sleeve whose internal threads are in permanent mesh with external threads of the two coupling elements. A shroud which surrounds the flexible coupling has a maximum-diameter tubular section rigid with the housing for the bearings, a minimum-diameter tubular section rigid with but detachable from the casing of the motor, and a median tubular section which penetrates into the maximum-diameter section when the intermediate shaft is lifted. When the minimum-diameter section is detached from the casing of the motor, it can be slid, together with the intermediate section, into the maximum-diameter section to thereby afford access to the flexible coupling. The rigid coupling has two coaxial coupling elements which are mounted at the upper end of the pump shaft and the lower end of the intermediate shaft and may have teeth which mate when the intermediate shaft assumes its lower end position in which it can drive the pump. (Official Gazette)

19599 COOLING MEANS FOR RADIAL BEARINGS IN NUCLEAR REACTOR PUMPS OR THE LIKE. Gaffal, K.; Honold, E.; Martens, R. (to Sulzer KSB Kernkraftwerkspumpen GmbH). US Patent 3,918,689. 11 Nov 1975. Priority date 7 Dec 1972, German, Federal Republic of (F. R. Germany). 6p.

A description is given of a pump for circulation of fluid in the interior of a nuclear reactor vessel which has a tubular member which extends upwardly into the vessel and with clearance through an opening in the bottom wall of the vessel. A sleeve-like bearing element has a lower portion received with minimal clearance in the tubular member and an upper portion which defines with the tubular member a first annular clearance having an enlarged ring-shaped upper portion for an auxiliary impeller which is driven by a pump shaft extending with clearance through the tubular member and having a second impeller in the interior of the vessel. The upper portion of the bearing element fixedly receives a bearing sleeve which defines with a cylindrical shield a second annular clearance communicating with a chamber for liquid coolant. The chamber is defined by a first mounting member which is received with clearance in the tubular member and supports the bearing element and a second mounting member which supports the shield and defines with the shaft a third annular clearance adapted to receive coolant through one or more channels in the lower portion of the second mounting member. When the chamber fails to receive a fresh coolant, the auxiliary impeller draws coolant from the lower part of the chamber, through the channel or channels of the second mounting member, through the third clearance, through one or more ports in the shield, through the second clearance, and into the upper portion of the first clearance. (Official Gazette)

19600 PROCESS AND APPARATUS FOR SEPARATING AND RECOVERING KRYPTON-85 FROM EXHAUST GAS OF NUCLEAR REACTOR OR THE LIKE. Yusa, H.; Kamiya, K.; Murata, T.; Yamaki, H.; Hisatomi, S. (to Hitachi, Ltd.). US Patent 3,922,150. 25 Nov 1975. Priority Date 25 Feb 1972, Japan. 16p.

An apparatus is described for separating and recovering radioactive krypton-85 contained in an exhaust gas of a nuclear reactor or the like, which comprises a plurality of adsorption beds connected in parallel with respect to a passageway for the exhaust gas, each being packed with activated carbon, wherein adsorption and desorption of krypton-85 in each of the beds are alternatively and repeatedly performed by operating valves disposed between each of the beds and means for reducing pressure in the beds to be desorbed in accordance with a predetermined time schedule. The adsorption and concentration efficiencies are markedly increased by combining the above adsorption apparatus and a distillation apparatus. (Official Gazette)

Reactor Fuels

Refer also to abstracts 16621, 17607, and 17619.

19601 (CEA-CONF-3075) THE MECHANISMS OF ELEMENT REDISTRIBUTION IN A NUCLEAR FUEL IRRADIATED AT HIGH TEMPERATURE. Gatesoupe, J. P. (CEA Centre d'Etudes Nucleaires de Fontenay-aux-Roses, 92 (France). Dept. d'Etudes des Combustibles a Base de Plutonium). 1975. 19p. (In French). INIS.

From colloquium of the French Chemical Society; Odeillo, France (25 Apr 1975).

The redistribution of O_2, U and Pu in the mixed oxides irradiated at high temperature was analyzed. The O_2 redistribution in solid phase leads to a rapidly reached stationary state. The U and Pu diffusion in solid phase is slower and leads to a Pu enrichment in the center of the fuel. The migration in vapor phase causes the oxide densification and a mass transfer around the oxide without modifying the composition. (FR)

19602 CONSTRUCTION OF SUPPORTING GRIDS FOR FUEL RODS (OR TUBES IN A HEAT EXCHANGER). (to Stichting Reactor Centrum Nederland). Netherlands Patent 7,503,822/A/. 1 Apr 1975. 6p. (In Dutch)

The construction of supporting grids for fuel rods (or tubes in heat exchangers) is described. It is a modification of a former French patent. The modification consists in the use of different material for the springs keeping the rod in place and describes another way of fixing these blade-shaped springs. Advantages of the specific spring characteristics were taken into consideration. (NL)

19603 OBSERVATIONS OF IRRADIATED FUEL BEHAVIOR UNDER SIMULATED ACCIDENT HEATING CONDITIONS. Roberts, J. T. A.; Wrona, B. J.; Fischer, D.; Buzzell, J. A. (Argonne National Lab., IL). Nucl. Technol.; 27: No. 2, 267-272(Oct 1975).

Modifications to the direct electrical heating apparatus have enabled it to be used successfully to heat irradiated mixed-oxide fuel pellets to melting in an alpha-gamma hot cell. For this purpose, a fuel extrusion device was constructed to remove irradiated fuel from its cladding. Proof-testing was successfully conducted using two UO_2–20 wt percent PuO_2 pellets irradiated in the Experimental Breeder Reactor II to 3.25 at. percent burnup at approximately 3.05 kW/m (approximately 10 kW/ft). The sequence of events leading to fuel failure—namely, melting, swelling, and fragmentation—agrees with observations from in-reactor accident simulations. (auth)

19604 FUEL ASSEMBLIES, GRAPPLES THEREFOR AND FUEL TRANSPORT APPARATUS FOR NUCLEAR REACTOR POWER PLANT. Jones, C. R. (to Transfer Systems Inc.). US Patent 3,917,335. 4 Nov 1975. Filed date 25 May 1973. 12p.

A description is given of a nuclear fuel assembly in which vertically disposed fuel elements are spaced within a housing generally of a rectanguloid configuration. Each fuel element includes an upper end plug and lower end plug. Vertically spaced support plates are disposed in the housing with suitable openings to receive the upper and lower end plugs of the fuel elements for supporting the fuel elements with the housing. The upper

plate is removable from the housing and the lower fuel plug is detachably connected to the lower plate. Other spacer plates are secured to the housing walls to reinforce same. A grapple having lifting plates with pins enters recesses formed in the housing for enabling the housing to be raised. After the fuel assembly is raised by the grapple, leaf spring retainers of the upper plate are dislodged for removing the upper plate from the housing. Now, the fuel elements can be removed selectively and individually from the fuel assembly by a removal tool. Aligned with and disposed above the removal tool is a transfer casing for housing the selectively removed fuel element while the selectively removed fuel element is transported to and from a fuel reprocessor. (Official Gazette)

19605 SINTERED NUCLEAR FUEL AND METHOD OF PREPARING SAME. Abate-Daga, G.; Amato, I. (to Fiat Societa per Azioni). US Patent 3,917,768. 4 Nov 1975. Priority date 25 Feb 1969, Italy. 6p.

A description is given of a method of preparing a nuclear fuel containing a consumable nuclear poison uniformly distributed therein in the form of coated micro-spheres of between 10 and 2,000 microns diameter, consisting in preparing sintered micro-spheres of the consumable poison, covering those micro-spheres with a protective coating and incorporating the coated micro-spheres into uranium dioxide powder, followed by sintering. (Official Gazette)

19606 NUCLEAR REACTOR FUEL ASSEMBLY. Sasaki, Y.; Tashima, J. (to Tokyo Shibaura Electric Co., Ltd.). US Patent 3,920,517. 18 Nov 1975. Priority Date 30 Jun 1970, Japan. 4p.

A description is given of nuclear reactor fuel assemblies arranged in the form of a lattice wherein there is attached to the interface of one of two adjacent fuel assemblies a plate spring having a concave portion curved toward said interface and to the interface of the other fuel assembly a plate spring having a convex portion curved away from said interface. (Official Gazette)

19607 NUCLEAR REACTOR FUEL ASSEMBLY ARRANGEMENT. Kmonk, S.; Sperhac, D. J. (to Westinghouse Electric Corp.). US Patent 3,920,516. 18 Nov 1975. Filed Date 25 Sep 1972. 6p.

A description is given of a structural arrangement for a nuclear reactor fuel assembly. Top and bottom support plates, comprising fuel assembly outlet and inlet nozzles respectively, are separated by a plurality of metal tubes. Metal grids which serve to space and support fuel rods containing nuclear fuel are spaced along the length of the metal tubes. The metal grids are structurally attached to the metal tubes by sleeves, made of the same material as the metal tubes, which are spring loaded into the metal grid and spot welded to the metal tubes passing therein. (Official Gazette)

19608 FUEL ASSEMBLY FOR A NUCLEAR REACTOR. Ferrari, H. M.; Miller, D. L.; Tong, L. S. (to Westinghouse Electric Corp.). US Patent 3,920,515. 18 Nov 1975. Filed Date 26 Sep 1972. 6p.

A description is given of a fuel assembly including multiple open channel grids for holding fuel rods and control rod guide thimbles in predetermined fixed relationship with each other. Metallic straps are interwoven to form a grid or egg crate configuration having openings which receive the fuel rods and guide thimbles. To properly support and cool the fuel rods near the grid-fuel rod interface, springs and dimples on the grid straps project into each opening, the dimples being oriented in a direction to permit flow of coolant upwardly therethrough. To minimize turbulence in coolant flow, the leading edge of each grid strap is provided with cutout sections which form scallops effective in channeling coolant in a uniform flow path through the network of grid openings. (Official Gazette)

Reactor Control Systems

19609 (FPS-C-1A) PRELIMINARY SPECIFICATION FOR THE PWAR-6 CONTROL ROD DRIVE SYSTEM. (Pratt and Whitney Aircraft, East Hartford, Conn. (USA)). [nd]. 8p. Dep. NTIS $3.50.

Declassified 9 Dec 1975.

Design requirements are presented for a control rod drive system for the PWAR-6 reactor. (auth)

19610 (TRG-Report-2716(D)) CONTROL ROD INTERACTION MODEL DEVELOPED TO MEET THE OPERATIONAL REQUIREMENTS OF THE PFR. Wheeler, R. C.; Tait, D.; Webster, E. B. (UKAEA Reactor Group, Dounreay. Dounreay Experimental Reactor Establishment). Aug 1975. 44p. Dep. NTIS (US Sales Only) $4.00.

Control rod worths in the Prototype Fast Reactor (PFR) are affected by the positions of other rods by up to 9% (adjacent rods) and 18% (opposite rods). Routine reactivity estimations, accountancy and rod calibrations are much aided by a control rod interaction model which was developed during the first few months of commissioning. The model described is part theoretical and part fitted to experimental results. It does not compete in precision with neutron diffusion theory results, but provides rapid answers to sufficient accuracy for most operational and routine safety requirements. Using the model for guidance, future recalibrations of the PFR rods should be accomplished with increased understanding and with less on-line time. (auth)

19611 ASSESSMENT OF THE RELIABILITY OF THE CNEN'S CALCULATIONAL METHODS FOR THE NEUTRONIC DESIGN OF PWRS. Gaafer, M. A.; Mango, L.; Orestano, F. V.; Pistella, F. (CNEN, Rome). Nucl. Technol.; 27: No. 2, 187-206(Oct 1975).

Methods have been formulated to treat the rod cluster control for present-generation pressurized water reactors within the computational codes available at Comitato Nazionale per l'Energia Nucleare (CNEN) for light water reactors. The reliability of these procedures has been verified by comparing the calculated results with the most significant experimental data available from measurements performed by the Centre d'Etude de l'Energie Nucleaire-Studiecentrum Voor Kernenergie (Belgian Plutonium Recycling Program), Babcock and Wilcox (Lumped Burnable Poison Program), Westinghouse, and CNEN (Italian Nuclear Ship Propulsion Program). Reactivity and power distributions have been evaluated for a wide set of experimental configurations including several types of absorbing rods (e.g., B_4C, Pyrex, and Ag-In-Cd alloy) with different radii in different lattices made of various fuel materials (e.g., UO_2, PuO_2, and UO_2/PuO_2). 36 references. (auth)

19612 AUTOMATION OF ELECTRIC HEATING SYSTEM AT A FAST REACTOR ATOMIC POWER PLANT. Mitropol'skii, A. N.; Tsukerman, I. Kh.; Petrenko, A. A. At. Energ. (USSR); 39: No. 2, 83-85(Aug 1975). (In Russian).

Problems of synthesizing electric heating automation processes at a fast reactor atomic power plant are considered. An analysis of dynamic properties of control objects and modelling preceded the development of the automation system. Centralized monitoring and control equipment of the Marcit 103 M type have been used successfully with the BN-350 reactor. The system can be recommended for future fast reactor atomic power plants. (auth)

19613 EXPERIMENTS IN POWER DISTRIBUTION CONTROL ON REACTOR IRT-2000. Filipchuk, E. V.; Potapenko, P. T.; Kryukov, A. P.; Trofimov, A. P.; Kosilov, A. N.; Neboyan, V. T.; Timokhin, E. S. At. Energ. (USSR); 39: No. 2, 90-93(Aug 1975). (In Russian).

The results of experimental investigations in neutron field control on research reactor IRT-2000 are presented. The validity of such experiments conducted on a reactor with a comparatively small core is substantiated. A successful application of self-powered detectors to neutron field control systems is described. Three system structures —a system with independent local regulators, a system with rigid intersecting couplings and a structure with a floating set point —are discussed. BT-2 serial regulators were used in the system. (auth)

19614 DIGITAL NUCLEAR REACTOR CONTROL ROD POSITION INDICATION SYSTEM. Reid, J. B. (to Westinghouse Electric Corp.). US Patent 3,919,043. 11 Nov 1975. Filed date 17 Oct 1973. 6p.

A description is given of a digital nuclear reactor control rod position indication system employing a plurality of Hall Effect transducers longitudinally spaced along the control rod drive housing. The transducers are individually responsive to a magnetic field generated by a magnetized portion of the control drive rod to respectively provide an output when in substantial proximity to the magnetized rod portion. The transducer outputs are multiplexed to display the relative position of the control rods within the reactor core. (Official Gazette)

Nuclear Power Plant Economics

19615 (CONF-740341-P2, pp vp Paper 8) ECONOMIC CONSIDERATIONS OF GENERATION PLANNING. Skooglund, J. W. 1974.

From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).

In 1974 electric utility engineering conference. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).

Some aspects of integrated operation of electric power systems that are of importance to system planning are examined. Faults in

the use of milk/kWh comparisons in evaluating the relative economics of nuclear and conventional power plants are pointed out. An accurate technique for making such comparisons is discussed. The economic integration of nuclear units with other types is also discussed. (JWR)

19616 (IEA-75-3) NET ENERGY FROM NUCLEAR POWER. Rotty, R. M.; Perry, A. M.; Reister, D. B. (Institute for Energy Analysis, Oak Ridge, Tenn. (USA)). Nov 1975. 133p. Dep. NTIS $6.00.

An analysis of net energy from nuclear power plants is dependent on a large number of variables and assumptions. The energy requirements as they relate to reactor type, concentration of uranium in the ore, enrichment tails assays, and possible recycle of uranium and plutonium were examined. Specifically, four reactor types were considered: pressurized water reactor, boiling water reactor, high temperature gas-cooled reactor, and heavy water reactor (CANDU). The energy requirements of systems employing both conventional (current) ores with uranium concentration of 0.176 percent and Chattanooga Shales with uranium concentration of 0.006 percent were determined. Data were given for no recycle, uranium recycle only, and uranium plus plutonium recycle. Starting with the energy requirements in the mining process and continuing through fuel reprocessing and waste storage, an evaluation of both electrical energy requirements and thermal energy requirements of each process was made. All of the energy, direct and indirect, required by the processing of uranium in order to produce electrical power was obtained by adding the quantities for the individual processes. The energy inputs required for the operation of a nuclear power system for an assumed life of approximately 30 years are tabulated for nine example cases. The input requirements were based on the production of 197,100,000 MWH(e), i.e., the operation of a 1000 MW(e) plant for 30 years with an average plant factor of 0.75. Both electrical requirements and thermal energy requirements are tabulated, and it should be emphasized that both quantities are needed. It was found that the electricity generated far exceeded the energy input requirements for all the cases considered. (auth)

19617 (PB-239675) AGRO-POWER-WASTE WATER COMPLEX FOR LAND DISPOSAL OF WASTE HEAT AND WASTE WATER. DeWalle, D. R. (Pennsylvania State Univ., University Park (USA). Inst. for Research on Land and Water Resources). Jun 1974. 208p. NTIS $7.25.

An Agro-Power-Waste Water Complex was evaluated as a system in which waste heat from power generation was dissipated by recycling hot water through a pipe network buried in agricultural land. Concurrently, municipal waste water was renovated by sprinkler irrigation on the land and served to maintain a high soil moisture content and soil thermal conductivity. A 0.23 acre field prototype of the Agro-Power-Waste Water Complex was constructed and measurements were obtained of soil temperature, soil thermal conductivity, heat dissipation, degree of waste water renovation, soil surface temperature used in a system analysis. The systems analysis indicated 4500 acres of land with 2-in. diameter pipe buried at 1-ft depth and 2-ft spacing in sandy soil would be required for a 1500 MWe nuclear electric plant. A nuclear fuel penalty concept was used in comparing this system with conventional heat dissipation systems. The preliminary results of a system design and cost analysis indicated the concept was less expensive than dry-cooling towers but more expensive than wet-cooling towers. (GRA)

19618 HOW COMPETITIVE IS ELECTRICITY FROM NUCLEAR POWER PLANTS. de Vries, B. Econ. Stat. Ber.; 60: No. 3015, 784-790(20 Aug 1975). (In Dutch)

Comparative evaluations between costs related to power generation from fossil fuel and nuclear power plants seem to favor nuclear power generation. However, due to comparatively slight differences and the many uncertain factors that may yet play a role, the advantages of nuclear power plants are reduced to almost nothing. This problem is surveyed considering investment, capital costs, interest, lifetime, supply rates and fuel cost combined with computations. (NL)

19619 ROLE OF NUCLEAR POWER IN THE FUTURE ENERGY SUPPLY OF THE WORLD. Lane, J. A.; Krymm, R.; Raisic, N.; Roberts, J. T. pp Paper 4.1-22, 22p. of 9th World Energy Conference. London; World Energy Conference (1974).

From 9th world energy conference; Detroit, Michigan, USA (22 Sep 1974). See CONF-740910-P4.

19620 ENERGY ANALYSIS OF NUCLEAR POWER STATIONS. Lindhout, A. H. Atoomenerg. Haar Toepass.; 17: No. 11, 237-239(Nov 1975). (In Dutch)

A study based on a 1000 MW(e) light water reactor power station was carried out to determine the total energy input and output of the power station. The calculations took into account the mining and processing of the ore, enrichment of the uranium, treatment of used nuclear fuel, investment in land, buildings, machinery, and transport. 144 tons of natural uranium produce 6100 million kWh (electric) and 340 million kWh (thermal) per annum. (NL)

19621 DISCONNECTION OF NUCLEAR POWER STATIONS AS A PROBLEM OF ENERGY ECONOMICS. Marzendorfer, H. Energiewirtsch. Tagesfragen; 24: No. 10, 476-482(Oct 1974). (In German)

The problems arising from the disconnection of a large generating unit following a fault, or for other reasons, have been analyzed. The increase in unit ratings in nuclear power stations and the development of supra-regional interconnections aggravate the problems. Short-term power-balance, long-term power balance and energy balance equations are given and the size and type of reserve generating capacity required for various operating conditions are discussed and typical costs are given. The solutions adopted in Austria are described. (9 refs.) (Elect. Electron Abst.)

Reactor Fuel Cycle Economics

Refer also to abstracts 16710, 16711, and 19411.

19622 IN-CORE FUEL MANAGEMENT VIA PERTURBATION THEORY. Mingle, J. O. (Kansas State Univ., Manhattan). Nucl. Technol.; 27: No. 2, 248-257(Oct 1975).

A two-step procedure is developed for the optimization of in-core nuclear fuel management using perturbation theory to predict the effects of various core configurations. The first procedure is a cycle cost minimization using linear programming with a zoned core and discrete burnup groups. The second program utilizes an individual fuel assembly shuffling sequence to minimize the maldistribution of power generation. This latter quantity is represented by a figure of merit or by an assembly power peaking factor. A pressurized water reactor example calculation is utilized. 24 references. (auth)

Reactor Licensing and Regulation

19623 (CONF-740341-P2, pp vp Paper 17) CHANGING FACE OF LICENSING. Salvatori, R.; Giglio, J. M. 1974.

From electric utility engineering conference; Pittsburgh, Pennsylvania, USA (3 Mar 1974).

In 1974 electric utility engineering conference. Volume II. (Westinghouse Electric Corp., Pittsburgh, Pa. (USA)).

The regulatory review process for nuclear power plants is described. Some of the problems and their near-term solutions are examined. The status of some technical issues, including ATWS, ECCS acceptance criteria, and reactor vessel integrity, is discussed. (JWR)

19624 (NRCI-75/11) NUCLEAR REGULATORY COMMISSION ISSUANCES, NOVEMBER 1975. (Nuclear Regulatory Commission, Washington, D. C. (USA)). Jan 1976. 118p. TIC $3.25.

Issuances received from the Atomic Safety and Licensing Appeal Boards and the Atomic Safety and Licensing Boards are presented. (DCC)

19625 (ORNL-5046, pp 93-95) APPLICATION OF ALAP CONCEPT TO LIGHT-WATER REACTORS. Dickson, H. W.; Kanduc, M. P.; Cottrell, W. D. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

A program to investigate the means by which the radiation exposure of workers at operating light water reactors can be reduced to the lowest practical levels is discussed. Doses in man-rems are given for a refueling outage at Pilgrim Nuclear Power Station and for a partial refueling outage at Big Rock Point Nuclear Power Station. (GHT)

19626 (REG/G-10.1(1-75)) COMPILATION OF REPORTING REQUIREMENTS FOR PERSONS SUBJECT TO AEC REGULATIONS. (USAEC Directorate of Regulatory Standards, Washington, D. C.). Jan 1975. 13p. NUREG.

This guide presents a compilation of all reporting requirements applicable to the various types of AEC licensees and other persons subject to AEC regulations, including identification of the proper AEC addressee or addressees and designation of the number of copies required. (auth)

19627 (WASH-1341 and (Amend.1)) PROGRAMMATIC INFORMATION FOR THE LICENSING OF STANDARDIZED NUCLEAR POWER PLANTS. (USAEC Regulation Directorate of Licensing, Washington, D. C.). Aug 1974. 65p. Dep. NTIS $4.50.

Additional guidance is presented by the Regulatory staff regarding the implementation of Options 1 (standard design) and 2 (duplicate plants) of the AEC's standardization policy for nuclear power plants. A discussion of the standardization policy is included, and the various aspects of the Regulatory processing of standard designs and duplicate plant designs are described. The current status of standardization application submittals is discussed. (auth)

19628 NUCLEAR POWER REGULATION IN THE UNITED STATES: A CURRENT DOMESTIC AND INTERNATIONAL PERSPECTIVE. Rowden, M. A. (Nuclear Regulatory Commission, Washington, DC). At. Energy Law J.; 17: No. 2, 102-122(Sum 1975).

From 1975 annual conference of the Japan Atomic Industrial Forum; Tokyo, Japan (11 Mar 1975).

A structural overview of the NRC is provided together with comments on the current agenda of compelling issues in the nuclear energy field. (DG)

19629 NEED FOR CREDIBLE NUCLEAR REGULATION. Anders, W. A. (Nuclear Regulatory Commission, Washington, DC). At. Energy Law J.; 17: No. 2, 123-142(Sum 1975).

From 43rd annual convention of the Edison Electric Inst.; Denver, CO, USA (4 Jun 1975).

Brief comments are made on the domestic energy outlook and on operational considerations in the regulatory process. Mention is made of court decisions, export-import licenses, safeguards, plutonium recycle, radiation release controls, and reactor licensing. (DG)

19630 NEED FOR NUCLEAR SAFEGUARDS. Gilinsky, V. (Nuclear Regulatory Commission, Washington, DC). At. Energy Law J.; 17: No. 2, 143-151(Sum 1975).

From Institute of Nuclear Materials Management conference; New Orleans, LA, USA (18 Jun 1975).

A brief discussion is presented of issues raised by the need for nuclear safeguards. Existing safeguards measures and new measures under consideration are mentioned. (DG)

19631 MUTUAL COOPERATION WITH STATE GOVERNMENTS. Kennedy, R. T. (Nuclear Regulatory Commission, Washington, DC). At. Energy Law J.; 17: No. 2, 152-158(Sum 1975).

From state workshop on nuclear energy centers; Denver, CO, USA (23 Jun 1975).

The basic principles under which the NRC operates in promoting credible nuclear regulation are described. The importance of effective federal-state cooperation is emphasized. (DG)

19632 RECENT ACTIONS BY THE NUCLEAR REGULATORY COMMISSION. Mason, E. A. (Nuclear Regulatory Commission, Washington, DC). At. Energy Law J.; 17: No. 2, 159-174(Sum 1975).

From American Nuclear Society conference; Boston, MA, USA (22 May 1975).

A brief discussion is presented of the following issues considered by the NRC: the as-low-as-practicable radiation release criteria; new legislation to improve the licensing and regulatory process; plans for evaluating benefits and risks of plutonium recycle; and a review of NRC responsibility for regulating the export and import of nuclear materials and facilities. (DG)

GENERAL AND MISCELLANEOUS

Civilian Defense

19633 (ORNL-5046, pp 1-13) STRATEGIC DEFENSE. Cristy, G. A.; Haaland, C. M.; Kearny, C. H.; Thurmer, R. N. Sep 1975.

In Health Physics Division annual progress report for period ending June 30, 1975. (Oak Ridge National Lab., Tenn. (USA)).

Topics discussed include national survival after a nuclear attack, Soviet civil defense studies, best shelter for critical industry workers, and expedient life-support equipment for shelters. (TFD)

Management

19634 (ORNL-5046) HEALTH PHYSICS DIVISION ANNUAL PROGRESS REPORT FOR PERIOD ENDING JUNE 30, 1975. (Oak Ridge National Lab., Tenn. (USA)). Sep 1975. Contract W-7405-eng-26. 323p. Dep. NTIS $10.60.

Separate abstracts were prepared for 25 sections of the progress report. (SFL)

For abstracts of individual sections see: 16615, 16831, 17226–17229, 17250, 17290, 17471, 17475–17478, 17491, 17722, 18346, 18383–18385, 19249–19257, 19504, 19558, 19625, and 19633.

19635 (PB-239718) STIMULATION AND RESERVOIR ENGINEERING OF GEOTHERMAL RESOURCES. Progress Report No. 3. Kruger, P.; Ramey, H. J. Jr. (Stanford Univ., Calif. (USA)). Jun 1974. 149p. (SGP-TR-1). NTIS $5.75.

The broad objectives of this program have been: (1) development of experimental and computational data to evaluate the optimum performance of fracture-stimulated geothermal reservoirs; (2) the development of a geothermal reservoir model to evaluate important thermophysical, hydrodynamic, and chemical parameters based on fluid-energy-volume balances as part of standard reservoir engineering practice; and (3) construction of a laboratory model of an explosion-product chimney to obtain experimental data on the processes of in-place boiling, moving flash fronts, and two-phase flow in porous and fracture hydrothermal reservoirs. (GRA)

19636 POSTGRADUATE TRAINING PROGRAM IN RADIATION HYGIENE. Carach, J.; Skokanova, K. Cesk. Hyg.; 19: No. 3, 133-136(1974). (In Czech).

The need for postgraduate training in radiation hygiene is discussed in view of the increasing range of activities involving radiation hazard and also in view of the new decrees valid in this respect in CSSR since 1972. A draft syllabus for the theoretical and practical postgraduate program is presented and improved pregraduate training in radiation hygiene is emphasized. (auth)

19637 PAEC'S NUCLEAR TRAINING INSTITUTE: A RETROSPECTIVE VIEW. De La Paz, L. (Philippine Atomic Energy Commission, Manila). Nucleus (Diliman, Quezon City); 13: No. 4, 6-8, 22-23(Mar 1975).

From 14th annual convention; Los Banos, Philippines (23 May 1975).

The following activities of the Nuclear Training Institute of the Philippine AEC are discussed: trainee movement and response; personnel turnover; overall picture; research papers and articles; projects completed; teaching of nuclear topics in a separate course; introducing nuclear topics in existing conventional courses; influence on agriculture; and influence on medicine. (HLW)

Mathematics and Computers

Refer also to abstracts 16795, 17478, 18653, and 19222.

19638 (CNLM-5282(Rev.1)) SCIENTIFIC COMPUTER FOR CANEL. (Pratt and Whitney Aircraft, Middletown, Conn. (USA). Connecticut Advanced Nuclear Engineering Lab.). 14 Feb 1964. Contract AT(30-1)-2789. 34p. Dep. NTIS $4.00.

The economics of available contemporary computers is discussed with respect to computing needs at CANEL. It was decided that purchase of the appropriate computer would be cheaper than continuing to rent. 20 figures. (RWR)

19639 (HMI-166) SCIENTIFIC PROGRESS REPORT 4–1974. (Hahn-Meitner-Institut fuer Kernforschung Berlin G.m.b.H. (F. R. Germany). Bereich Datenverarbeitung und Elektronik). 1974. 158p. (In German). INIS.

With figs. and tabs. Available from ZAED.

The Sector Data Processing and Electronics carries out applied research as well as development and service activities for the other sectors of HMI in the field of data processing, digital and analog systems of measuring, and electronic modular design. Concerning data processing the emphasis is put on developing an interconnected network, whereby the numerous process computers (mostly of type PDP 11) of HMI are to be connected with the central S 4004/151 which would result in a data processing unit fully sufficient to the requirements of a modern research center. (DE)

19640 (RL-75-154) SYSTEM SOFTWARE FOR EXPERIMENTAL APPLICATIONS ON A GEC4080. Charles, B. J.; Maden, D. (Science Research Council, Chilton (UK). Rutherford Lab.). Sep 1975. 11p. (CONF-7509109-1). Dep. NTIS (US Sales Only) $3.50.

From conference on on-line computers; London, United Kingdom of Great Britain and Northern Ireland (UK) (Sep 1975).

A general-purpose message switching system was developed at the Rutherford Laboratory for use on GEC4080's in conjunction with the manufacturer's disc based operating system, DOS. Particular applications of the system are in on-line data acquisition from a nuclear physics experiment and in the on-line monitoring of a linear accelerator. Both applications use CAMAC in the interfacing between the experimental apparatus and the computer. This paper describes the main features of the system and the way in which these features are used in a particular example of data acquisition. (3 figures) (auth)

19641 (UCRL-51969) COMPUTERIZED DATA BASE OF THE FUNDAMENTAL CONSTANTS OF NATURE. Henry, E. A.; Hampel, V. E. (California Univ., Livermore (USA). Lawrence Livermore Lab.). 3 Dec 1975. Contract W-7405-Eng-48. 18p. Dep. NTIS $4.00.

Fifty-seven fundamental constants of nature were computerized from the up-to-date evaluations of E. R. Cohen and B. N. Taylor. The constants are annotated with regard to symbol, value, uncertainty, and scaling factor. This computerization is part of the scientific data base project of the Information Research Group at Lawrence Livermore Laboratory. The MASTER CONTROL data base management system is used. The computerized fundamental constants can be requested from the ERDA Computer Program Exchange and Information Center of the Argonne National Laboratory or from the National Technical Information Service of the U. S. Department of Commerce. This is the first of a series of releases on preparation of computerized scientific and technological data banks. The next release is a data bank of conversion factors for different units of measurements. 3 figures.

19642 NUMERICAL SOLUTION OF INTEGRAL EQUATIONS. Delves. L. M.; Walsh, J. (eds.). Oxford; Clarendon Press (1974). 334p.

The subject is covered in three parts. Part I deals with mathematical preliminaries, in the theory of integral equations, in numerical analysis, function spaces and approximation theory. Part II considers the main numerical methods used for the different types of integral equations, treating general classes of problems rather than particular cases. In Part III some fields of application of integral equations are surveyed. The final chapter in Part III, dealing with scattering problems in quantum mechanics, is in NSA scope, and a separate abstract has been prepared for it. (YK)

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